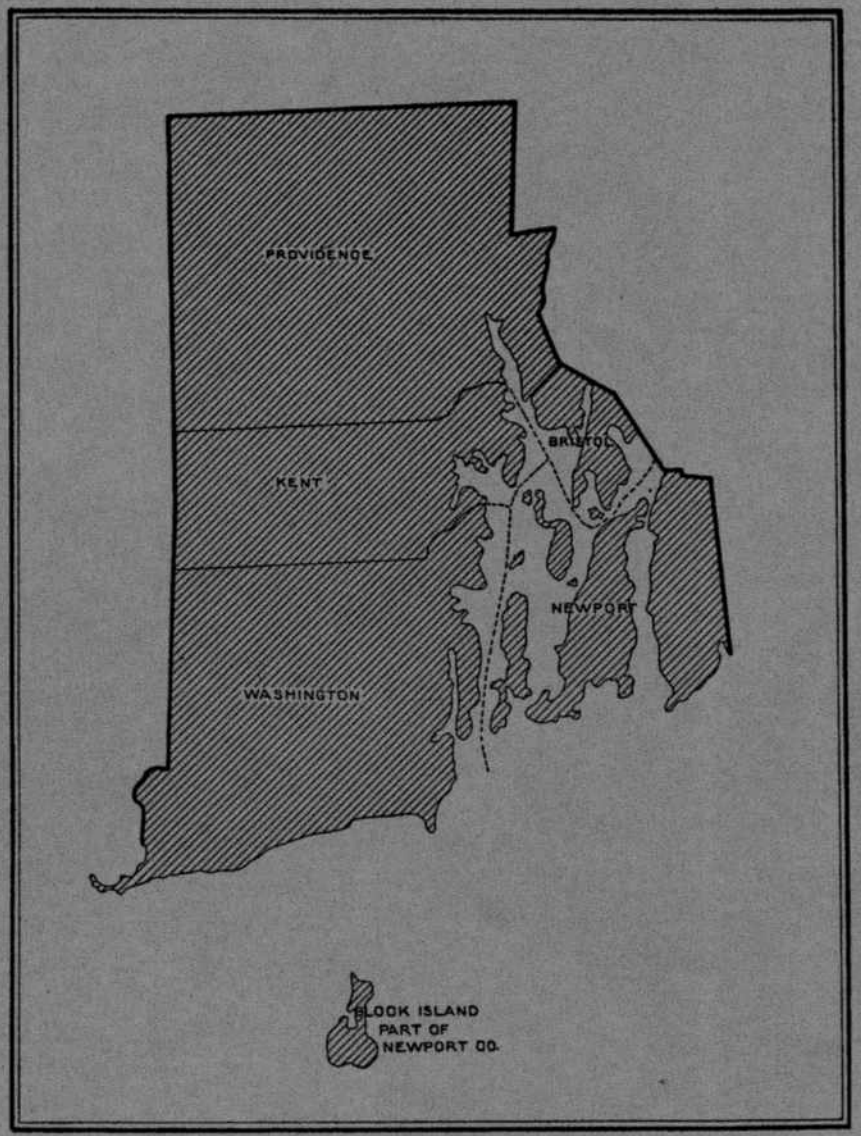

Areas surveyed in Rhode Island, shown by shading

Series 1936, No. 18 Issued August 1942

Soil Survey

Newport and Bristol Counties Rhode Island

By
A. E. SHEARIN
United States Department of Agriculture, in Charge
and
S. V. MADISON and W. S. COLVIN
Rhode Island Agricultural Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
In cooperation with the
Rhode Island State College Agricultural Experiment Station

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Series 1936, No. 18 Issued August, 1942

SOIL SURVEY OF NEWPORT AND BRISTOL COUNTIES, RHODE ISLAND

By A. E. SHEARIN, Division of Soil Survey,[1] Bureau of Plant Industry, United States Department of Agriculture, in Charge, and S. V. MADISON and W. S. COLVIN, Rhode Island Agricultural Experiment Station

Area inspected by W. J. LATIMER, Inspector, District 1

United States Department of Agriculture, Bureau of Plant Industry, in cooperation with the Rhode Island State College Agricultural Experiment Station

CONTENTS

INTRODUCTION

The soil survey map and report of the counties of Newport and Bristol, Rhode Island, are intended to convey information concerning the soils, crops, and agriculture of these counties to a wide variety of readers.

Farmers, landowners, prospective purchasers, and tenants ordinarily are interested in some particular locality, farm, or field. They

[1] The field work for this survey was done while the Division was a part of the Bureau of Chemistry and Soils.

need to know what the soil is like on a certain piece of land, what crops are adapted, what yields may be expected, and what fertilization and other soil-management practices are needed for best results. Many people do not wish to read the entire soil survey report, and they need not do so to obtain much of the information essential to their purpose.

A person interested in a particular piece of land should first locate it on the colored soil map accompanying the report. Then, from the color and symbol, he can identify the soils in the legend on the margin of the map. By using the table of contents, he can find the description of the soils in the section on Soils and Crops. Under each soil type heading is specific information about that particular soil. There is a description of the landscape—lay of the land, drainage, stoniness (if any), vegetation, and other external characteristics—and the internal or profile characteristics of the soil—its color, depth, texture, structure, and chemical or mineralogical composition. The description includes information about the use now made of the land, crops grown, and yields obtained, and statements concerning possible uses and present and recommended management.

By referring to the section on Productivity Ratings the reader may compare the soil types as to productivity for the various crops and suitability for the growth of crops or for other uses.

For the person unfamiliar with the area or region, a general description of these counties is given in the first part of the report. Geography, physiography, regional drainage, relief, vegetation, climate, population, transportation facilities, and markets are discussed. A brief summary at the end gives a condensed description of the counties and important facts concerning the soils and agriculture.

The agricultural economist and general student of agriculture will be interested in the sections on Agricultural History and Statistics and on Productivity Ratings.

Soil specialists, agronomists, experiment station and agricultural extension workers, and students of soils and crops will be interested in the more general discussion of soils in the section on Soils and Crops as well as in the soil type descriptions. They will also be interested in the section on Productivity Ratings.

For the soil scientist, the section on Morphology and Genesis of Soils presents a brief technical discussion of the soils and of the soil-forming processes that have produced them.

COUNTIES SURVEYED

LOCATION AND EXTENT

Newport and Bristol Counties are in the southeastern part of Rhode Island (fig. 1). These counties are separated from Washington and Kent Counties on the west by Narragansett Bay. Newport, the county seat of Newport County, is 23 miles southeast of Providence, 20 miles southwest of Fall River, Mass., and 75 miles south of Boston, Mass. Bristol, the county seat of Bristol County, is 13 miles southeast of Providence and 60 miles southwest of Boston.

Newport County is very irregular in outline, and about one-half of its area is made up of islands, the largest of which are Rhode

Island, Conanicut, and Prudence in Narragansett Bay and Block Island in the Atlantic Ocean. Block Island is about 25 miles southwest of Newport and 15 miles northeast of Montauk Point, Long Island, N. Y. The area of Newport County is 114 square miles, or 72,960 acres. Bristol County to the north is separated from Newport

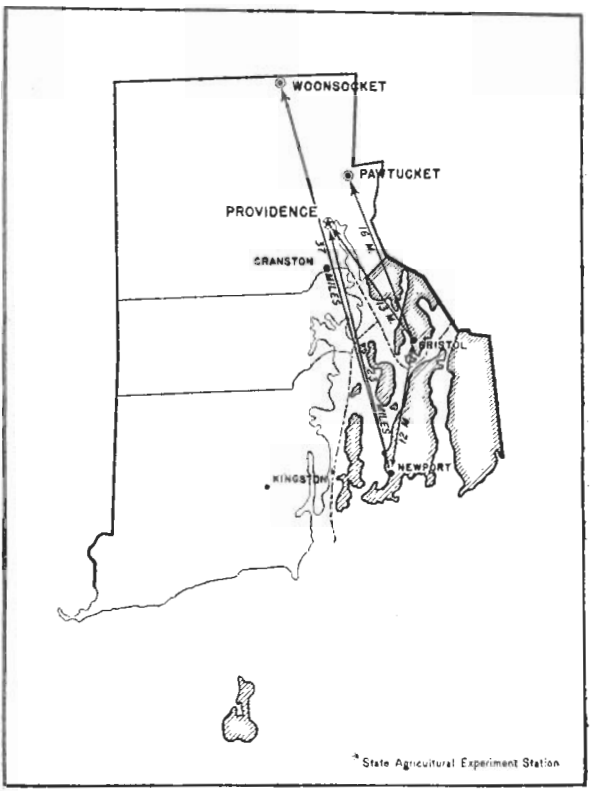

FIGURE 1.—Sketch map showing location of Newport and Bristol Counties, R. I.

County by Narragansett Bay and Mount Hope Bay. The land area of Bristol County is 24 square miles, or 15,360 acres. The total area of the two counties is 138 square miles, or 88,320 acres.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

The two counties lie largely within the Narragansett Basin division, an area of comparatively smooth low hills and glacial plains adjacent to the bay. In general, the relief is characterized by fairly smooth rounded hills with gentle slopes, the hills not exceeding 300 feet in height except at one point, and nearly level to gently undulating glacial plains. The smooth slopes of the uplands are broken here and there by short choppy and fairly steep slopes. From a geological point of view the area may be divided into three divisions based on the underlying rocks and glacial till or outwash material from which the soils have developed. Approximately the northern one-third of

Bristol County is a glacial plain with nearly level to gently undulating relief. The underlying materials are stratified coarse sand and rounded pieces of gravel, and they have given rise to soils ranging in texture from loamy sand to fine sandy loam. The bedrocks underlying the rest of the area, except a narrow strip in the eastern part of Newport County along the Massachusetts State line and Block Island, consist mostly of conglomerates, sandstone, shales, and coals of the Carboniferous period. In many places these rocks have been overlain by glacial till composed of materials coarser than the underlying rocks, but the soils show the influence of the finer grained underlying rocks. Most of the soils of this area are of loam or fine sandy loam texture and are the best soils for general farm crops. A narrow strip in the eastern part of Newport County, along the State line, is underlain by granite, gneiss, schist, and other crystalline rocks. These rocks have been overlain by glacial till composed mostly of granitic material that has given rise to the Gloucester and Narragansett soils of fine sandy-loam texture.

Block Island is decidedly morainic in character and is characterized by rough, choppy, and irregular relief interspersed with numerous small fresh-water lakes and poorly drained pot holes or depressions. This island is part of a terminal moraine formed by glacial debris dumped some distance out to sea from the present shore line, and the soils are somewhat variable in texture and depth.

No large streams flow through Newport County. Drainage is effected through small streams and intermittent drains, most of which flow to the south, southwest, and southeast. They either flow through or head in the poorly drained flats and depressions of the uplands. They are not swift-flowing, have not carved out narrow valleys, and in only a few places is there any recent deposition of alluvial material. Stafford Pond in the northeast corner of Newport County is the only fresh-water lake of any consequence in the area.

Owing to continual action of waves, the coast line of the mainland and the islands of Newport County is marked by steep cliffs in many places.

Drainage in Bristol County also is effected mainly through small streams or intermittent drains, which flow into Mount Hope Bay, Narragansett Bay, or Barrington, Warren, and Kickamuit Rivers. The Barrington, Warren, and Kickamuit Rivers in the northern part of Bristol County are fairly large streams that rise and fall with the tide and are bordered in places by tidal marshes.

The elevation of the two counties ranges from sea level to a maximum of about 340 feet[2] on Pocasset Hill in the town[3] of Tiverton, Newport County. Except in the northeastern part of Newport County the elevation does not rise above 300 feet. The elevation over most of the area ranges from sea level to about 160 feet.

[2] Elevations from U. S. Geological Survey topographic sheets.

[3] In Rhode Island, as in the other New England States, the chief political subdivision is the town. This corresponds somewhat to the township in other sections of the country, although in some respects it is more like a county in its political functioning.

VEGETATION

Originally both counties were covered with a dense and vigorous forest growth [4] consisting of chestnut; white and pitch pines; white, red, black, and chestnut oaks; walnut; hickory; cedar; beech; birch; and maple. The distribution of the species was determined to some extent by the texture and drainage of the soils. On the lighter textured well-drained soils the predominating trees probably were various species of oak and pitch pine, and on the heavier textured upland soils the predominating trees probably were white pine, chestnut, beech, and oaks. Red maple and swamp white cedar probably were the predominating trees on the poorly drained and the organic soils, respectively.

At present about one-half of the area is practically bare of forest. The open land is under cultivation, is used for grazing, or lies idle. Much of the land on Block Island, Conanicut Island, and Prudence Island, and small areas in other places near the coast have been cleared of trees and are now lying idle. Some of this land has been idle for many years, and because of the fairly strong and constant wind from the ocean reforestation has not taken place.

Scattered gray birch and redcedar grow in places. A greater part of the town of Tiverton and the western part of the town of Little Compton in Newport County and parts of the town of Barrington in Bristol County support a small, and, in places, a stunted and brushy forest growth. Small farms are scattered over these districts, but only a small percentage of the land is cleared. On the light-textured, well-drained soils white oak and scrub oak predominate, with some red oak, black oak, pitch pine, and chestnut sprouts. Blueberries and sweetfern are common. On the heavier soils that are not so well drained, oaks predominate. The red, black, and scarlet varieties are more common than white oak. Here grow also a few white pine, some red maple, gray birch, and chestnut sprouts, together with a thick underbrush of blueberries, laurel, and bull briers. On the poorly drained areas red maple predominates, with some swamp white oak, black tupelo (sour gum), gray birch, yellow birch, and an underbrush of hardhack spirea, bayberry, holly, bull briers, and sumac. Most of the present forest growth in the area is of little value except for cordwood. Most of the land in the towns of Middletown and Portsmouth has been cleared of the forest growth, except for scattered wood lots where the predominant tree is beech, with some red oak, scarlet oak, shadbush, cherry, and red maple.

On the open areas that have not been cultivated for several years bayberries, goldenrod, dewberries, and blackberries form the predominant growths. The most common grasses on these areas are Colonial (Rhode Island) bentgrass, fine-leaved fescue, broomsedge, poverty oatgrass, Kentucky bluegrass, Canada bluegrass, and redtop. The most common weeds are ragweed, goldenrod, wild carrot, sheep sorrel, field daisy, poison-ivy, quackgrass, crabgrass, chickweed, haircap moss, and ladies tobacco. The weeds most common in hayfields

[4] ARNOLD, SAMUEL GREENE. HISTORY OF THE STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS. 2 v., illus. New York. 1859–60.

are dandelions, narrow-leaved plantain, wild carrot, narrow-leaved dock, ragweed, quackgrass, field daisy, crabgrass, and yarrow.

Following is a list of scientific and common names of plant species native in this area:

Scientific and common names of the common trees, shrubs, and herbs in Newport and Bristol Counties, R. I.

TREES

Scientific name	*Common name*
Acer rubrum L.	Red maple.
Alnus incana (L.) Moench	Speckled alder.
Alnus rugosa (DuRoi) Spreng	Smooth alder.
Betula lenta L.	Sweet (black) birch.
Betula lutea Michx	Yellow birch.
Betula populifolia Marsh	Gray birch.
Carya glabra (Mill.) Sweet (syn. *Hicoria glabra*)	Pignut hickory.
Castanea dentata (Marsh) Borkh	American chestnut.
Chamaecyparis thyoides (L.) Britt., Sterns, and Poggenb	Atlantic white-cedar.
Cornus florida L.	Flowering dogwood.
Fagus grandifolia Ehrh	American beech.
Fraxinus americana L.	White ash.
Juniperus virginiana L.	Eastern redcedar.
Nyssa sylvatica Marsh	Black tupelo (sour gum).
Pinus rigida Mill	Pitch pine.
Populus grandidentata Michx	Bigtooth aspen.
Populus tremuloides Michx	Quaking aspen.
Quercus bicolor Willd	Swamp white oak.
Quercus coccinea Muench	Scarlet oak.
Quercus ilicifolia Wangh	Bear (scrub) oak.
Quercus maxima (March.) Ashe	Red oak.
Quercus prinus L.	Swamp chestnut oak.
Quercus velutina Lam	Black oak.
Tsuga canadensis (L.) Carr	Eastern hemlock.
Ulmus americana L.	American elm.

SHRUBS

Clethra alnifolia L.	Summersweet (sweet pepper bush).
Comptonia peregrina (L.) Coult. (syn. *Myrica asplenifolia*)	Sweetfern.
Gaylussacia baccata (Wangh.) C. Koch	Huckleberry.
Gaylussacia frondosa (L.) Torr. and Gray	Dangleberry.
Ilex opaca Ait	American holly.
Juniperus communis L.	Common juniper.
Kalmia angustifolia L.	Lambkill (sheep laurel).
Kalmia latifolia L.	Mountain-laurel.
Myrica pennsylvanica Lois. (syn. *M. carolinensis*)	Bayberry.
Rhus glabra L.	Smooth sumac.
Rhus toxicodendron L.	Poison-ivy.
Rhus vernix L.	Poison sumac.
Rubus allegheniensis Porter	Allegheny blackberry.
Rubus flagellaris Willd	Dewberry.
Rubus hispidus L.	Swamp dewberry.
Spiraea tomentosa L.	Hardhack.
Smilax rotundifolia L.	Horsebrier (bull brier).
Vaccinium angustifolium Ait. var. *laevifolium* House (syn. *V. pennsylvanicum*)	Lowbush blueberry.
Vaccinium corymbosum L.	Highbush blueberry.
Viburnum dentatum L.	Arrowwood.

HERBS, WEEDS, AND GRASSES

Achillea millefolium L.	Yarrow.
Agrostis alba L.	Redtop.
Agrostis tenuis Sibth.	Colonial (Rhode Island) bentgrass.
Ambrosia artemisifolia=*A. artemisiifolia* L.	Ragweed.
Andropogon scoparius Michx.	Prairie beardgrass.
Anthoxanthum odoratum L.	Sweet vernalgrass.
Baptisia tinctoria (L.) R. Br.	Wild-indigo.
Chrysanthemum leucanthemum L.	Field daisy.
Dactylis glomerata L.	Orchard grass.
Danthonia spicata (L.) Beauv.	Poverty oatgrass.
Daucus carota L.	Wild carrot.
Digitaria sanguinalis (L.) Scop.	Crabgrass.
Festuca ovina L.	Sheep fescue.
Fragaria virginiana Duchesne.	Strawberry.
Onoclea sensibilis L.	Sensitive fern.
Osmunda cinnamomea L.	Cinnamon fern.
Osmunda regalis L.	Royal fern.
Phleum pratense L.	Timothy.
Plantago lanceolata L.	Narrow-leaved plantain.
Poa compressa L.	Canada bluegrass.
Poa pratensis L.	Kentucky bluegrass.
Polytrichum sp.	Haircap moss.
Potentilla canadensis L.	Silvery cinquefoil.
Pteridium aquilinum (L.) Kuhn (syn. *Pteris aquilina*)	Bracken.
Rumex acetosella L.	Field or sheep sorrel.
Rumex crispus L.	Yellow dock.
Solidago sp.	Goldenrod.
Stellaria media (L.) Cyrill.	Common chickweed.
Taraxacum officinale Weber.	Dandelion.
Trifolium hybridum L.	Alsike clover.
Trifolium pratense L.	Red clover.
Trifolium repens L.	White clover.
Typha latifolia L.	Cattail.

SETTLEMENT AND POPULATION

The first settlement in the area was at Portsmouth in Newport County.[5] This was made in 1638 by a band of religious freethinkers who were dissenters from the Puritan Colony of Massachusetts Bay. Roger Williams, who had settled at Providence in 1636, welcomed these settlers. Newport was founded in 1639 by a group of dissenters from the Portsmouth Colony. Newport County was incorporated in 1703 as Rhode Island County. Its present name was adopted in 1729, and the towns of Tiverton and Little Compton were annexed from Massachusetts in 1746, rounding out the present boundaries. Bristol County was incorporated in 1647 with the same county limits that it now has.

Agriculture was the chief pursuit of the early settlers. Such crops as Indian corn, rye, barley, beans, and potatoes were grown for consumption at home. Practically every family had a few domestic animals. The prosperity of the early colonists was due largely

[5] BAYLES, RICHARD M., ed. HISTORY OF NEWPORT COUNTY, RHODE ISLAND, FROM THE YEAR 1638 TO THE YEAR 1887. . . 1060 pp., illus. New York. 1888.

to the friendly policy inaugurated by Roger Williams with the Narraganset and Wampanoag Indians. Nevertheless, a conflict between the whites and Indians was inevitable, and these struggles culminated with the "Great Swamp Fight" near Kingston in 1675. From that time on the Indians became less and less significant in the affairs of Rhode Island.

According to the Federal census the total population in Newport County was 41,668 in 1930; 14,056, or 33.7 percent, of whom were classified as rural. The average density of population was 123.3 persons a square mile. Newport, with a population of 27,612 in 1930 is the county seat and the largest and most important city in Newport County. The United States War College and one of the United States Naval training stations are located on Coasters Harbor Island near Newport. The United States Torpedo Station is on Goat Island near Newport, and Fort Adams and a naval hospital are on the mainland near the city. Jamestown is the only other population center of any size in the county; other smaller trading centers are New Shoreham on Block Island, Tiverton, Little Compton, and Adamsville. The total population of Bristol County, as reported by the Federal census of 1930 was 25,089, all classed as urban, and the average density was 1,045.4 a square mile. Bristol, the county seat, and Warren are the principal local trading centers.

TRANSPORTATION AND MARKETS

Highway transportation in both counties is good. Hard-surfaced State roads connect all important trading centers in both counties with Providence, Fall River, Boston, and other points. Motorbus lines serve all important points except Block Island. Motortrucks handle most of the agricultural products shipped out of the area. Ferry service is maintained from Newport, via Jamestown, to the mainland at Saunderstown in Washington County. Daily steamboat service is available between Providence and Block Island, via Newport, for passengers, freight, and mail. Ocean-going freighters supply the two counties with such materials as lumber, coal, iron, steel, and crude and refined oils.

A branch line of the New York, New Haven & Hartford Railroad carries freight between Newport, Fall River, Providence, and other points. An electric interurban railway maintains daily passenger service between Providence, Warren, and Bristol. Good State and town roads reach all parts of both counties. Most of the town roads are hard surfaced or graveled and are kept in fair to good condition. Every community has adequate schools, churches, public libraries, and free mail service. Probably over 75 percent of the farm population has electricity and telephone service in their homes.

Newport is the principal market for the agricultural products produced in Newport County; and Providence, Fall River, and Boston are markets for some of the farm produce. Roadside stands do a good business along the main roads in both counties. Bristol, Warren, Providence, and Riverside furnish the principal markets for the farm produce of Bristol County. Many farmers make a practice of catering to the tourist trade during the summer.

There are no important manufacturing industries in the area. One shipbuilding plant at Bristol is engaged in building and repairing pleasure craft. Several attempts have been made to mine coal in the town of Portsmouth, Newport County, but, as the coal is of poor quality, the mines have been abandoned. The shellfish industry is important in both counties and furnishes employment to many people. Many clams, oysters, lobsters, scallops, and quahogs are obtained from the shores and waters of Narragansett Bay and the Atlantic Ocean. The shellfish in this section are of very good quality. Deep-sea fishing also is important, especially around Block Island. Swordfish, tuna, bluefish, mackerel, and sea bass are some of the fish commonly caught. During the summer many people find employment on the large estates.

CLIMATE

The climate of Newport and Bristol Counties is oceanic. Because of the proximity of the Atlantic Ocean and Narragansett Bay, the climate is modified and warmed in winter and correspondingly is cooled in summer. The summers are comparatively cool, with a few periods of hot weather, generally of short duration. The winters are cold, but zero and subzero temperatures do not last long. The precipitation is uniformly distributed through the seasons. Usually the moisture supply is sufficient and is uniformly distributed for the growth of crops, although occasional droughts or excessive rainfall damage the crops considerably. The climatic conditions are favorable for general farming, dairying, market gardening, orcharding, and for the raising of livestock and poultry.

The average length of the frost-free season at Block Island, Newport County, is 217 days—from April 10 to November 13. Frost has been recorded at this station as late as April 26 and as early as October 11. The average frost-free season at Providence, Providence County, is 188 days—from April 11 to October 23. Killing frost has been recorded at this station as late as May 10 and as early as September 23. The mean temperature at Providence is several degrees cooler in winter and several degrees warmer in summer than at Block Island. The seasonal temperatures and frost-free seasons vary in the two counties, according to the proximity of the ocean and of Narragansett Bay. The frost-free season generally is sufficiently long for the maturing of all crops commonly grown.

Violent thunderstorms occur occasionally during the summer but, as a rule, do not cause heavy damage. Hailstorms also occur occasionally and may cause considerable local damage to growing crops and fruits.

The fairly cool summer climate, combined with the numerous and easily accessible beaches, makes this area a very popular summer resort. The tourist season begins about June 1 and ends about Labor Day. The trade thus created is an important source of income.

Tables 1 and 2 give the normal monthly, seasonal, and annual temperature and precipitation, as recorded by the United States Weather Bureau stations at Block Island and Providence.

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TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Block Island, Newport County, R. I.*

[Elevation, 33 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1888)	Total amount for the wettest year (1884)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	36.0	61	−6	3.80	1.23	6.56	3.9
January	31.0	59	−4	3.78	2.12	6.43	4.4
February	30.4	58	−6	3.66	1.14	7.31	5.1
Winter	32.5	61	−6	11.24	4.49	20.30	13.4
March	35.4	68	6	3.83	2.80	6.40	3.4
April	44.0	78	14	3.53	1.35	4.10	.9
May	52.8	82	31	3.48	3.54	6.39	.0
Spring	44.1	82	6	10.84	7.69	16.89	4.3
June	61.8	88	44	2.62	.62	2.59	.0
July	68.4	92	52	3.08	1.03	6.52	.0
August	68.5	90	49	3.67	1.32	6.41	.0
Summer	66.2	92	44	9.37	2.97	15.52	.0
September	63.4	86	38	2.66	5.49	.62	.0
October	54.9	77	30	3.56	2.37	3.89	.0
November	44.6	70	14	3.63	4.17	5.93	.4
Fall	54.3	86	14	9.85	12.03	10.44	.4
Year	49.3	92	−6	41.30	27.18	63.15	18.1

TABLE 2.—*Normal monthly, seasonal, and annual temperature and precipitation at Providence, Providence County, R. I.*

[Elevation, 8 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1914)	Total amount for the wettest year (1898)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	31.6	68	−12	3.38	2.93	2.54	5.8
January	27.2	64	−9	3.70	3.56	6.01	8.9
February	29.0	69	−10	3.64	2.99	6.45	10.0
Winter	29.3	69	−12	10.72	9.48	15.00	24.7
March	35.7	84	4	3.49	3.38	2.95	5.5
April	46.6	88	11	3.21	3.94	6.08	1.6
May	58.5	94	32	2.96	1.88	4.07	(1)
Spring	46.9	94	4	9.66	9.20	13.10	7.1
June	68.3	96	42	2.68	.58	1.16	.0
July	73.4	100	50	3.27	2.81	10.26	.0
August	71.0	97	46	3.50	2.02	6.00	.0
Summer	70.9	100	42	9.45	5.41	17.42	.0
September	63.2	95	33	3.18	.48	2.26	.0
October	52.2	87	27	3.12	2.97	8.43	(1)
November	40.4	75	12	3.06	1.96	7.29	.6
Fall	51.9	95	12	9.36	5.41	17.98	.6
Year	49.8	100	−12	39.19	29.50	63.50	32.4

[1] Trace.

AGRICULTURAL HISTORY AND STATISTICS

The chief pursuit of the early settlers was agriculture, which centered around Portsmouth and Newport and gradually spread to other parts of the area. Travel was difficult and transportation facilities meager, so the settlers were compelled to be practically self-sustaining. Very little produce was exchanged between communities, and trading was chiefly with the Indians. Indian corn, barley, rye, beans, and potatoes were the first crops grown. Apples were introduced in the early days, and small fruits, such as blueberries and blackberries, were important.

Clearing the land of stones and trees was a very slow process, and as the fields were cleared the stones were built into stone fences. Despite the task of clearing the land, agriculture developed rapidly, especially around Newport and other parts of the two counties bordering on or near the bay and ocean. The colonial system of farming was developed extensively on the lands near Narragansett Bay, that is, most of the land was divided into large plantations averaging about 300 acres each and worked by slaves. The raising of cattle and horses became important. This section was soon able to produce such products as pork, butter, cheese, wool, and horses for export.

Fishing and shipbuilding were early industries. Newport played a very important part in the early days of American history. Rhode Island's merchants traded with the West Indies, parts of continental Europe, and early in the eighteenth century coastwise trade along the North American coast became important.

With the beginning of manufacturing early in the nineteenth century the population began to concentrate in the villages and cities. The needs of these growing centers for the products of the farm and the development of transportation facilities made farming more a commercial business, and agriculture advanced rapidly until around 1880. With the still further improvement in transportation facilities, the opening up of the more fertile and easily tilled lands of the West, and the development of manufacturing in New England, many people were lured away from the Rhode Island farms. Consequently, agriculture became less and less important in Newport and Bristol Counties and in New England generally. The percentage of land in farms, according to the Federal census, decreased steadily in Newport County from 77.2 percent in 1879 to 51.1 percent in 1929. From 1929 to 1934 the percentage increased from 51.1 percent to 58.3 percent, when 42,535 acres was in farms. In Bristol County the percentage of land in farms decreased from 82.9 percent in 1879 to 46.7 percent in 1934, when 7,173 acres was in farms. In 1934, 26,127 acres in Newport County and 3,918 acres in Bristol County was improved land, including cropland and plowable pasture. A fairly large percentage of the land in these two counties is, at present, in large estates or is held by large landowners or real-estate companies for purposes of investment. At present, agriculture is not important on the small islands because of their distance from markets and the high cost of transportation to and from the mainland.

The present agriculture of the two counties consists principally of dairy farming, market gardening, poultry raising, and potato growing. Other enterprises of less importance are orcharding, growing of nursery stock, flower culture, small-fruit culture, and cattle raising. The most intensively cultivated parts of Newport County are found

in the towns of Middletown and Portsmouth, a narrow strip east of the Sakonnet River in Tiverton Town, and about one-half of Little Compton Town in the southeast corner. Agriculture is of secondary importance on Block, Conanicut, and Prudence Islands.

Tables 3 and 4, compiled from the Federal census, gives the acreages of the principal crops grown in Newport and Bristol Counties in stated years.

TABLE 3.—*Acreages of the principal crops grown in Newport County, R. I., in stated years*

Crop	1879	1889	1899	1909	1919	1929	1934
Corn:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
For grain	2,941	2,177	2,089	2,903	2,483	711	785
For other purposes					[1] 1,041	1,834	1,246
Oats:							
Threshed	2,156	1,562	703	1,181	784	201	203
Cut and fed unthreshed						386	323
Rye	120	73	43	115	47	17	19
Barley	413	226	198	159	138	13	4
Potatoes	931	1,550	1,990	1,835	1,061	810	1,316
Vegetables harvested for sale					473	1,314	2,145
All hay	15,888	17,616	12,856	11,497	9,035	7,453	10,134
Timothy and timothy and clover mixed				9,996	6,680	4,768	4,993
Clover alone			103		131	373	[2] 64
Alfalfa			2	4	32	76	86
Grains cut for hay			573	207	240	165	303
Legumes cut for hay					6		38
Other tame hay			12,081	1,220	1,940	1,984	4,650
Wild hay			97	70	6	87	([3])
Strawberries			43	38	14	43	36
	Trees	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*
Apples		15,598	13,462	8,739	10,247	5,621	9,472
Peaches		399	3,227	4,436	6,452	8,555	9,848

[1] Forage only.
[2] Includes only sweetclover and lespedeza; other clover included with timothy and timothy and clover mixed.
[3] Included with other tame hay.

TABLE 4.—*Acreages of principal crops grown in Bristol County, R. I., in stated years*

Crop	1879	1889	1899	1909	1919	1929	1934
Corn:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
For grain	546	416	335	624	492	71	6
For other purposes					[1] 203	451	533
Oats:							
For grain	158	134	118	26	46	15	10
Cut and fed unthreshed						26	
Rye	73	51	54	65	59	6	4
Barley	22	15					
Potatoes	340	312	230	275	227	111	262
Vegetables harvested for sale					209	244	476
All hay	3,499	3,301	1,855	2,129	1,463	1,404	1,738
Timothy and timothy and clover mixed				823	1,137	1,090	329
Clover alone			3	1	10	38	([2])
Alfalfa				22	13	50	43
Grains cut for hay			150	143	70	47	79
Legumes cut for hay					5		5
Other tame hay			1,635	1,015	220	173	1,282
Wild hay			67	125	8	6	([3])
Strawberries			11	7	7	8	5
	Trees	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*
Apples		6,591	3,599	3,779	4,103	4,396	3,866
Peaches		458	655	610	6,800	195	157

[1] Forage only.
[2] Included with timothy and timothy and clover mixed.
[3] Included with other tame hay.

The acreage in corn (for grain) decreased steadily since 1879 in both counties, except for a brief revival about 1909. Silage corn, however, has become increasingly important since 1919, and in 1934 the acreage in corn harvested for grain in Newport County was about half of the acreage in corn for other purposes. The acreage in corn harvested for grain has decreased still further since 1934. Other grains show the same decrease as corn. It will be noted that the acreage in vegetables has been important since 1909 and that the acreage increased greatly during the period 1929–34.

Hay occupies a much larger acreage than any other crop. All the hay and forage is fed to livestock on farms. At least 75 percent of the hay crop is mixed, consisting of timothy with clover, alfalfa, redtop, Colonial (Rhode Island) bentgrass, and orchard grass in varying combinations. Small acreages are devoted to alfalfa, clover alone, oats for forage, millet, wheat and vetch for forage, and wheat for grain. Many hayfields are pastured after cutting the hay.

Since 1909 the production of vegetables for market has become important. Sweet corn occupies a fairly large acreage in the two counties, and, when the sweet corn is harvested, most of the fodder is cut for silage. On some market-garden farms, sweet corn fodder is turned under as a green manure. Other market-garden crops are grown intensively in the vicinity of Newport, in Newport County, and in Bristol County. The most common truck crops are cabbage, tomatoes, beets, carrots, beans, peas, spinach, broccoli, cauliflower, squash, peppers, lettuce, onions, cucumbers, turnips, and eggplant. Providence, Fall River, and Boston offer excellent markets for produce that is not consumed locally.

The acreage in potatoes increased rapidly from 1879 to 1899 in Newport County and then decreased until 1929, after which it again increased. In Bristol County the acreage in potatoes has remained fairly constant. Potatoes are grown in both counties for market and for home use. With fertilization, spraying, and thorough cultivation good yields are obtained. Green Mountain and Irish Cobbler are the principal varieties grown.

Growing of nursery stock and flower culture are important enterprises, especially, near Newport. Several large nurseries operate in this vicinity.

Commerical fruit growing is not important in these counties, although there are several small orchards that produce apples and peaches commercially. Small fruits, such as strawberries and raspberries, are grown in a limited way for market and for home use.

Table 5 gives the value of certain agricultural products of the two counties in stated years.

The use of commercial fertilizer and lime is general. Most farmers recognize the value of lime in growing legumes, for increasing crop yields in general, and as an economical method of improving cropland. A large part of the lime used in Newport and Bristol Counties comes from a lime rock quarry north of Providence, in Providence County. According to the Federal census of 1930, 73.4 percent of the farmers of Newport County used commercial fertilizer in 1929; the expenditure reported was $115,903 or $252.51 per farm reporting its use. In Bristol County 68.1 percent of the farms reported the use of commercial fertilizer in 1929, which had a total

value of $20,550 or an average of $209.69 per farm reporting its use.

TABLE 5.—*Value of certain agricultural products in Newport and Bristol Counties, R. I., in stated years*

Product	Newport County			Bristol County		
	1909	1919	1929	1909	1919	1929
Crops:						
Cereals	$144,397	$234,554	$41,691	$17,980	$46,005	$3,307
Other grains and seeds	126	1,623	1,377	2,032	149	31
Hay and forage	262,423	513,727	268,024	49,169	102,688	66,178
Vegetables (including all potatoes)	286,041	462,448	440,052	73,486	131,584	67,382
Vegetables for home use (excluding potatoes)			49,958			12,988
Fruits	37,136	68,540	66,514	8,008	35,250	16,395
All other field crops	185,106			25,522		
Nursery and hothouse products			300,213			325
Forest products			12,574			3,604
Livestock products:						
Dairy products sold	351,710	928,267	1,145,089	71,747	164,875	256,487
Poultry and eggs produced	433,164	272,483	418,725	59,113	81,862	112,916
Honey and wax	509	283	[1] 203	[1] 25		[1] 98
Wool and mohair	[2] 2,765	[2] 1,782	909	[2] 137	[2] 94	[2] 61

[1] Honey only.
[2] Wool only.

Commercial mixed fertilizers are most commonly used. However, some farmers mix their own, and some of the unmixed chemicals are applied separately. The grades of fertilizer in general use for corn are 5–8–7,[3] 4–12–4, and 4–8–4; for market-garden crops and potatoes, 5–8–7, 5–10–10, 8–16–16, and 4–8–10.

On the dairy farms most of the available manure is used on silage corn. This is supplemented with about 300 pounds of commercial fertilizer per acre. Corn is usually followed by grass, which receives 300 to 400 pounds of fertilizer and 1 ton of lime per acre at seeding time. Seaweed is used where available as a top dressing on the hayfields and is thought to be about as valuable pound for pound as stable manure. On the market-garden farms all available manure is used and ½ to 1 ton of fertilizer per acre annually, and lime every 2 to 5 years at the rate of 1 to 2 tons per acre. Rye and buckwheat are the crops most commonly grown as green-manure crops.

The 1930 census reported 8,320 cattle, valued at $793,170, in Newport County and 1,730 cattle, valued at $157,186, in Bristol County. These numbers decreased slightly to 7,301 and 1,418, respectively, in 1935. The cattle are principally good grade dairy cattle of the Guernsey, Holstein-Friesian, and Jersey breeds. Some purebred herds of these breeds are found and purebred bulls are common. Several herds of beef cattle of Hereford and Aberdeen Angus breeds are kept in Newport County. Almost all of the dairy products are marketed in the form of whole milk. In 1929, 3,671,433 gallons were produced in Newport County and 829,812 gallons in Bristol County. In 1934, the production declined slightly to 3,651,178 gallons in Newport County, and increased to 855,370 gallons in Bristol

[3] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

County. Milk and milk products not consumed locally in these two counties find a ready market in Providence and in Fall River.

Most of the roughage for the cattle is produced locally, but most of the grain and other concentrated feeds are shipped in from other States. This accounts for a large percentage of the feed bill for the two counties which amounted to $819,937 in 1929, according to the Federal census. Sheep raising is not important, although the number of sheep seem to be increasing in Newport County.

Raising poultry is an important agricultural enterprise in the two counties. In 1929, 416,538 dozen eggs, valued at $212,434, were produced and 104,420 chickens, valued at $167,072, were raised in Newport County; whereas 125,538 dozen eggs, valued at $64,024, were produced and 28,733 chickens, valued at $45,973, were raised in Bristol County. In 1934, 389,588 dozen eggs were produced and 108,993 chickens were raised in Newport County; whereas 230,200 dozen eggs were produced and 45,440 chickens were raised in Bristol County. Rhode Island Red is the most important breed, with Plymouth Rock, New Hampshire Red, and White Leghorn being less important. Very little feed for poultry is produced in the counties; therefore, most of the grain is shipped in from other States. Some poultry farmers provide green feed for chickens on the range in summer. Poultry products not consumed locally are sold in Providence, Fall River, and Boston. The number of turkeys, ducks, and geese raised is small.

Hog raising is not important. Only 457 and 256 hogs, respectively, were reported on farms by the 1935 census in Newport and Bristol Counties. A few farmers raise hogs on a commercial scale, but practically none of them produce any pork for home use.

The number of horses, as reported by the Federal census, decreased from 1,547 in 1920 to 934 in 1935 in Newport County and from 334 in 1920 to 177 in 1935 in Bristol County. A large proportion of the horses are of draft type and are used as work horses on the farms. One farm in Newport County has about 30 purebred brood mares, including several Percheron, and is breeding horses commercially. Most of the heavy work and hauling on the farms is done at present with tractors and trucks. Horses are becoming less and less important, especially on the dairy and poultry farms. The market-garden farmers use horses mostly for cultivation.

According to the 1935 Federal census the total number of farms in Newport County was 868. The average size of the farms was 49.0 acres with the number of acres of improved land per farm averaging 30.1 acres. In Bristol County the total number of farms was 193, the average size of farm was 37.2 acres, and the improved land per farm 20.3 acres. The average assessed value of farm land and buildings was $209.46 per acre in Newport County and $296.47 per acre in Bristol County. The size of farms varies, but most of them are small.

In 1929, 61.4 percent of the farms in Newport County hired labor at a total expenditure of $591,374 or an average of $1,540.04 per farm reporting. In Bristol County, 68.1 percent of the farms hired labor at a cost of $132,392 or an average of $1,350.94 per farm reporting. Most of the farm labor is done by local white men. The county agent states that the average farm wage is about $50 per

month with board or $65 to $70 without board. Farm labor has been scarce for the last few years according to many farmers and the county agent.

Farm tenure has changed little in either county since 1880. In 1934, as reported by the Federal census, 79.6 percent of the farms in Newport County were operated by owners, 18.4 percent by tenants, and 2.0 percent by managers. In Bristol County 81.9 percent of the farms were operated by owners, 14.0 percent by tenants, and 4.1 percent by managers. The farms operated by tenants are rented on a cash basis and the amount of rent varies depending on location, improvements on the farms, and character of the soil. Some tenants lease farms for a number of years.

Most of the farmhouses in Newport and Bristol Counties are well built, modern, and in good condition. The barns are well built and sufficiently large to shelter the livestock and farm machinery and to store hay and other feeds. Farm machinery and farm equipment on a large percentage of the farms is modern and up to date.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field.

The soils are examined systematically in many locations. Test pits are dug, borings are made, and exposures, such as those in road or railroad cuts, are studied. Each excavation exposes a series of distinct soil layers, or horizons, called, collectively, the soil profile. Each horizon of the soil as well as the parent material beneath the soil, is studied in detail; and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil [7] and its content of lime and salts are determined by simple tests. Drainage, both internal and external, and other external features, such as relief or lay of the land, are taken into consideration, and the interrelationships of soils and vegetation are studied.

The soils are classified according to their characteristics, both internal and external, special emphasis being given to those features influencing the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics soils are grouped into classification units. The three principal ones are: (1) series, (2) type, and (3) phase. Areas of land, such as coastal beach or bare, rocky mountainsides, which have no true soil, are called miscellaneous land types.

The most important of these groups is the series, which includes soils having the same genetic horizons, are similar in their important characteristics and arrangement in the soil profile, and were developed from a particular type of parent material. Thus, the series includes soils having essentially the same color, structure, and other important internal characteristics and the same natural drainage conditions and range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The soil series are given names of places or geographic features near which they were

[7] The reaction of the soil is its degree of acidity or alkalinity, expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values indicate alkalinity, and lower values indicate acidity.

first found. Thus, Newport, Gloucester, Merrimac, and Warwick are names of important soil series in these counties.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of the soil texture, such as sand, loamy sand, sandy loam, loam, silt loam, clay loam, silty clay loam, and clay, is added to the series name to give the complete name of the soil type. For example, Newport loam and Newport fine sandy loam are soil types, within the Newport series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the soil unit to which agronomic data are definitely related.

A phase of a soil type is a subgroup of soils within a type, which differ in some minor soil characteristic that may, nevertheless, have an important practical significance. Differences in relief, stoniness, and the degree of accelerated erosion frequently are shown as phases. For example, within the normal range of relief for a soil type, there may be areas that are adapted to the use of machinery and the growth of cultivated crops and others that are not. Even though there may be no important differences in the soil itself or in its capability for the growth of native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such an instance the more sloping parts of the soil type may be segregated on the map as a sloping or a hilly phase. Similarly, soils having differences in stoniness may be mapped as phases, even though these differences are not reflected in the character of the soil or in the growth of native plants.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS AND CROPS[8]

The soils of Newport and Bristol Counties have developed under a forest cover of mixed hardwoods and conifers. They do not differ essentially from soils occupying similar physiographic positions in other sections of southern New England. The materials from which the soils have developed were accumulated largely through glacial action and deposited by the receding glacier as till or as outwash by the melting glacier. Small areas have developed from recent alluvial material and from organic accumulations.

The soils are comparatively young, and the mode of deposition and character of the parent material are strong contributing factors to the soils and control their distribution.

The Newport soils are by far the most extensive; they have developed from glacial materials composed largely of shales and slates,

[8] No attempt was made in mapping to join with the 1920 soil survey of Bristol County, Mass., because of the more advanced methods of soil classification and the greater detail used in mapping the soils of Newport and Bristol Counties. Therefore, many discrepancies occur along the Rhode Island and Massachusetts State line where these counties join. The soils mapped Coloma in Massachusetts have been changed to Tiverton, Newport, and Compton because of the varying degrees of shale and slate content, whereas the Coloma now is being held to glacial material of almost pure sandstone origin. In the closely built-up sections of the city of Newport the soils were not classified. The soils on several small islands in Narragansett Bay and the Sakonnet River were not mapped because they are of little agricultural importance.

with some sandstone and conglomerate. The Tiverton soils have developed from materials composed largely of conglomerate, sandstone, and granitic gneiss. These soils, which are not extensive, occur in the northeastern part of Bristol County and in the northern part of the town of Tiverton, Newport County. The Gloucester and Narragansett soils, developed largely from granitic materials, occur in the extreme eastern parts of the towns of Tiverton and Little Compton and on Block Island, Newport County. These soils have been influenced largely by glacial till and to less extent by the underlying rock. When the first white settlers arrived, about 300 years ago, the upland soils were stony, but the stones and boulders were not so numerous as in some other sections of New England with more rolling or broken relief. This fact, together with the favorable location and the fact that the soils when cleared produced good yields of various crops, was conducive to the clearing of much of the land of stone and trees. A much smaller percentage of the Gloucester and Narragansett soils is cleared and cultivated than of the Newport, Bernardston, Tiverton, and Compton soils. In no other counties in Rhode Island and possibly in New England is there as large a percentage of the area of the glaciated uplands cleared of stone. Much of the land that once was cultivated is now in large estates or summer colonies, is lying idle, or is being held for investment purposes.

The texture and structure of a large percentage of the soils of these two counties are conducive to good root penetration, water percolation, adequate drainage, and a high water-holding capacity, and, therefore, the soils are adapted to a variety of crops. With proper care and fertilization good yields are obtained. The combination of favorable soil and a humid climate has made Rhode Island favorable for the growth of forests, and when the land is cleared the same conditions favor the growth of grasses and other crops.

The soils developed on the terraces are nearly level, have good to excessive drainage, are stone free, and are variable in texture. These soils, in general, have developed from coarser materials than the soils of the glaciated uplands, are leached to a greater extent, and are less fertile. Both the surface soils and subsoils have good structure, however, and produce fair to good yields of certain crops, with fertilization and an adequate moisture supply. The largest area of the outwash soils is in the northwestern part of Bristol County, but small scattered areas are in Newport County. The outwash materials have given rise to soils of the Warwick and Merrimac series, depending on whether the materials from which the soils have developed are mostly shale and sandstone or light-colored granitic materials.

The poorly drained soils occur in narrow strips throughout both counties. Part of this land is in forest or brush, and some is cleared or partly cleared and is utilized for pasture.

All the soils of the area are acid in all layers, varying from strongly acid to moderately acid.[9] In general, the Newport soils are the least acid and the Gloucester the most acid of the till soils. The pH value of the surface soils of the Newport soils ranges from 4.5 to 5.5, whereas the pH value of most of the Gloucester surface soils is less than 4. The Tiverton soils are slightly more acid than the Newport

[9] Field tests made with Soiltex.

soils, and the Narragansett soils are slightly more acid than the soils of the Tiverton series.

Most farmers realize that certain crops are better adapted to certain soil types than others; that is, that early vegetables are better adapted to light-textured well-drained soils, and such crops as hay and corn are better adapted to the heavier textured soils. There is no distinct correlation, however, between the soil types and crops grown in these two counties.

The soils range in texture from loamy sand to silty clay loam. A large percentage of the well-drained soils consists of loams and fine sandy loams. The soils vary in the color of the different layers, owing to differences in drainage and in the character of the parent material from which they have developed.

Based on the fundamental characteristics that determine their importance in the agriculture of the area and their capabilities for use the soils are arranged in six broad groups. Such factors as stoniness, relief, physiography, drainage, agricultural use, and adaptability serve as the basis for this grouping, which is as follows: (1) Nonstony well-drained till soils; (2) stony well-drained till soils; (3) well-drained to droughty soils of the outwash plains; (4) droughty soils of the kames; (5) imperfectly drained and poorly drained soils; and (6) miscellaneous land types.

In the following pages the groups of soils and the individual soil types are described, and their agricultural relationships are discussed; their location and distribution are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 6.

TABLE 6.—*Acreage and proportionate extent of the soils mapped in Newport and Bristol Counties, R. I.*

Soil type	Acres	Per-cent	Soil type	Acres	Per-cent
Newport loam	4,672	5.3	Warwick very fine sandy loam	320	0.4
Newport loam, level phase	6,016	6.8	Warwick fine sandy loam	2,432	2.7
Newport loam, slope phase	576	.7	Warwick gravelly fine sandy loam	640	.7
Newport loam, steep phase	512	.6	Warwick sandy loam	768	.9
Newport fine sandy loam	4,480	5.1	Merrimac fine sandy loam	448	.5
Newport fine sandy loam, level phase	3,968	4.5	Merrimac sandy loam	576	.7
Newport loamy fine sand	576	.7	Merrimac loamy sand	832	.9
Newport loamy fine sand, level phase	576	.7	Quonset gravelly fine sandy loam	1,472	1.7
Newport loamy sand	448	.5	Newport loam, imperfectly drained phase	1,088	1.2
Bernardston loam	3,712	4.2	Compton loam, imperfectly drained phase	704	.8
Bernardston loam, level phase	4,672	5.3	Mansfield silty clay loam	3,648	4.1
Compton loam	1,536	1.7	Mansfield stony silty clay loam	1,984	2.2
Compton loam, level phase	1,536	1.7	Mansfield silt loam	2,048	2.3
Tiverton gravelly fine sandy loam	768	.9	Mansfield loam	2,496	2.8
Tiverton gravelly fine sandy loam, level phase	384	.4	Mansfield stony loam	1,856	2.1
Tiverton gravelly loam	704	.8	Whitman stony loam	2,496	2.8
Narragansett fine sandy loam	2,176	2.5	Whitman silty clay loam	128	.1
Narragansett fine sandy loam, level phase	1,600	1.8	Scarboro loam	448	.5
Gloucester fine sandy loam	384	.4	Scarboro fine sandy loam	512	.6
Gloucester stony fine sandy loam	4,480	5.1	Muck and peat	1,344	1.5
Gloucester stony fine sandy loam, steep phase	2,880	3.3	Muck and peat, shallow phase	768	.9
Narragansett stony fine sandy loam	2,368	2.7	Peat, salt-marsh phase	832	.9
Newport stony fine sandy loam	704	.8	Tidal marsh	1,216	1.4
Newport stony loam, steep phase	1,344	1.5	Alluvial soils, undifferentiated	320	.4
Bernardston stony loam	576	.7	Rough stony land	2,304	2.6
Tiverton stony gravelly fine sandy loam	1,280	1.4	Coastal beach	704	.8
Tiverton stony gravelly fine sandy loam, level phase	384	.4	Dune sand	448	.5
Tiverton stony fine sandy loam, steep phase	256	.3	Made land	704	.8
			Unclassified city land	1,216	1.4
			Total	88,320	100.0

NONSTONY WELL-DRAINED TILL SOILS

The nonstony well-drained till soils are members of the Newport, Tiverton, Bernardston, Narragansett, Compton, and Gloucester series that are free or practically free of stones on the surface. This group of soils is by far the most important in the area from an agricultural point of view, and a large percentage of them is under cultivation. The largest areas lying idle or used for pasture are on Block Island, Conanicut Island, and Prudence Island. These areas support mainly a shrub and grass vegetation consisting largely of bayberry, dewberry, Colonial (Rhode Island) bentgrass, Kentucky bluegrass, broomsedge, and poverty oatgrass. A few small trees grow here and there.

The Newport and Bernardston soils, the most extensive of the group, represent some of the best farm land in Rhode Island. The Newport, Bernardston, and Compton soils differ in color and in thickness of the different layers, owing to development, to slight differences in composition of the parent materials, and to slight differences in drainage. For instance, the Compton soils are darker throughout than the Newport soils, because the till from which the Compton soils have developed contains a higher percentage of slates. On the other hand, the Bernardston soils are influenced less by the slates and drainage is better, therefore, the different layers are lighter colored than the corresponding layers in the Newport soils.

The Tiverton, Narragansett, and Gloucester soils are of comparatively small extent, but they are important in the sections of the counties where they occur.

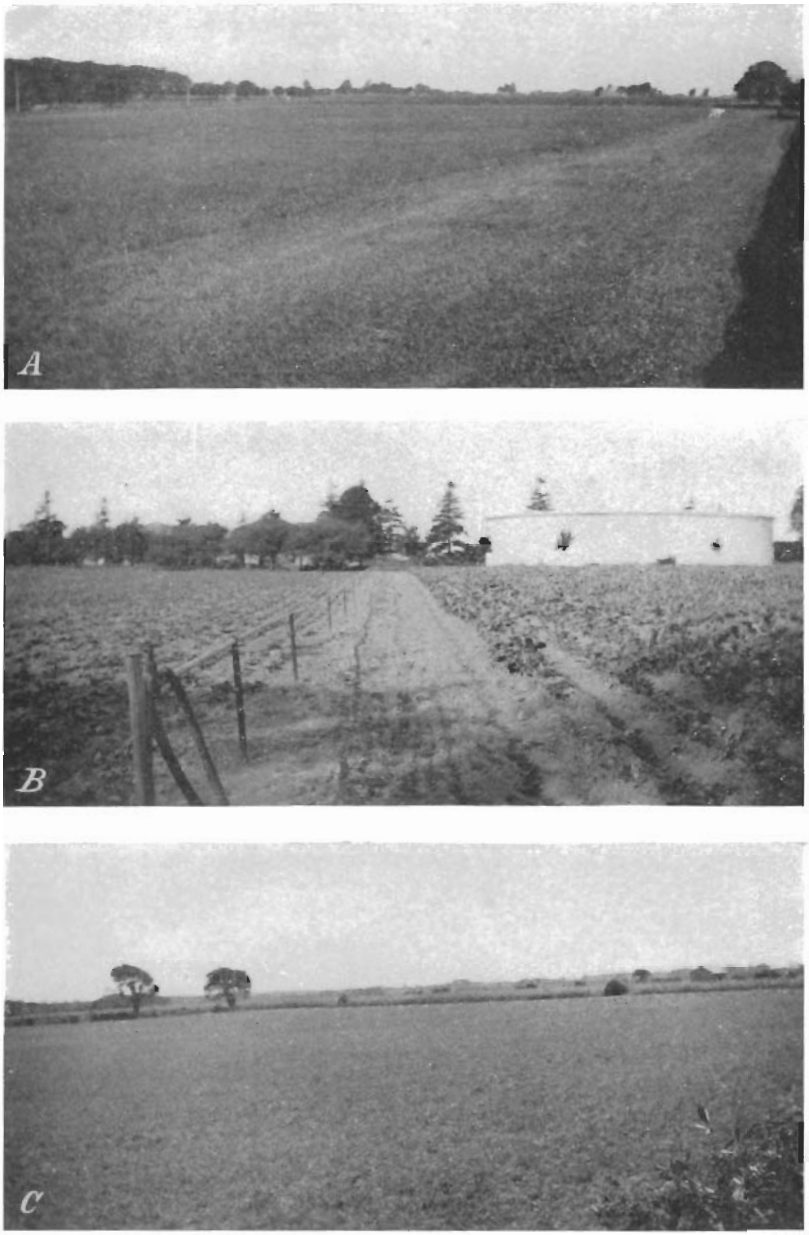
On probably 95 percent of the soils of this group, the relief ranges from nearly level or gently sloping (pls. 1 and 2) to sloping, that is, the slope does not exceed about 10 percent. In a few places there are narrow strips where the slopes may be as much as 25 to 30 percent, and on Block Island the relief is decidedly rolling in places. Both surface and internal drainage are fair to good. The Gloucester soils are the best drained of the group. The other soils are underlain by fairly compact to compact substrata, and drainage is not so rapid.

Erosion is not a serious problem, but sheet erosion is rather active on some of the more sloping areas if planted to clean-cultivated crops such as corn, potatoes, and market-garden crops.

These soils are managed easily and respond to fertilization and care. The heavier textured soils are best adapted to corn and hay, whereas the lighter textured ones are well suited to the production of certain market-garden crops. On a large percentage of the farms the fields are large enough for tractors to be used to advantage.

Newport loam.—Practically all of this soil has been cleared of trees and stones, and most of it is cultivated or in pasture. In cultivated fields it is characterized by a grayish-brown or brown mellow friable loam surface soil from 5 to 8 inches thick. The surface has a slate gray or somewhat green tinge. On a freshly cut surface or when the material is pressed between the fingers the brown color is intensified. The subsoil is very pale yellowish-brown or dingy-brown friable porous loam continuing to a depth of 16 to 20 inches where it grades into olive-gray friable gritty and gravelly light loam. At a depth ranging from 24 to 30 inches, the lower subsoil layer grades into dark olive-gray or bluish-gray fairly compact but friable gritty

A, Characteristic relief of Newport loam; *B*, hayfield on Newport loam, level phase with silage corn in background; *C*, lima beans on Bernardson loam.



A, Recently mowed hayfield on Bernardston loam, level phase, with nursery stock in background. *B*, Cauliflower and spinach grown under irrigation on Bernardston loam, level phase. *C*, Characteristic level surface of the Warwick and Merrimac soils. Hayfield with silage corn in background on Warwick very fine sandy loam.

and gravelly partly weathered till, which is composed largely of shales, sandstone, and conglomerate materials and becomes darker, coarser, and less modified with depth. Flat shale, sandstone, and other rock fragments are scattered over the surface and embedded in the subsoil. The gravel on the surface, however, is not sufficient to interfere appreciably with cultivation.

This soil is fairly uniform in texture, structure, and color, and it occupies long, smooth slopes (pl. 1, *A*) ranging from 3 to about 10 percent. Both external and internal drainage are good. Owing to the open and porous character of this soil and the fairly compact substratum, the water-absorbing and water-holding capacities are comparatively high and internal drainage is not excessive. Under proper management this soil can easily be built up and maintained in a productive state. The relief is favorable for all farming operations. Some care, however, must be exercised to control sheet erosion on some of the more sloping areas if planted to clean-cultivated crops. These areas should be cultivated along the contour, and the crops should be rotated with grasses and legumes as often as possible.

This soil is not extensive, but it is important in the agriculture of the area. It occurs in scattered bodies over the southern part of Bristol County, and in the towns of Portsmouth, Middletown, Little Compton, and Tiverton in Newport County.

The principal crops are hay, silage corn, market-garden crops, and potatoes. Small acreages are devoted to alfalfa, sweet corn, field corn, nursery stock, and small fruits. This is probably the best soil in the area for the production of hay and corn and for pasture. Hay, timothy alone or mixed, yields from 1½ to 3 tons an acre, silage corn 10 to 15 tons, sweet corn 600 to 1,200 dozen ears, alfalfa 3 to 5 tons, field corn 40 to 60 bushels, and potatoes 200 to 325 bushels. Market-garden crops, such as cabbage, spinach, beans, squash, and tomatoes, yield well. Early peas, beets, carrots, and other root crops yield well but are better adapted to lighter textured soils. Some of the market gardeners stress quality rather than high yields. Cabbage yields from 300 to 400 bushels an acre, tomatoes 300 to 500 bushels, string beans 250 to 350 bushels, carrots 400 to 500 bushels, and beets 300 to 400 bushels. Hayfields generally receive an application of stable manure and from 1 to 2 tons of lime to the acre when seeded. A few farmers also apply 200 to 400 pounds of fertilizer. Some farmers side dress with manure or seaweed if it is available. Corn receives a heavy application of manure and from 300 to 400 pounds of 5–8–7 or 4–8–4 commercial fertilizer to the acre. There is a general tendency to use a fertilizer higher in phosphorus or to add superphosphate for the corn crop. Potatoes generally are fertilized with about 1 ton to the acre of 5–8–7 or 5–10–10 commercial fertilizer. Market-garden crops receive an acre application ranging from 1,000 to 2,000 pounds of 5–8–7 commercial fertilizer, about 1 ton of lime every 3 years, and manure if available. Most market gardeners turn under rye as a green-manure crop in the spring. Some buckwheat is grown as a green-manure crop.

Newport loam, level phase.—Newport loam, level phase, is closely associated with typical Newport loam and is essentially the same in all respects except relief. This soil occurs in nearly level to very gently sloping areas (pl. 1, *B*) or on slopes not exceeding 3 percent. Surface

drainage is not so rapid as on typical Newport loam, but both surface and internal drainage are adequate.

Included in mapping are very small saucerlike areas, or depressions, where the drainage is not so good. These areas are of no great agricultural importance.

The same crops are grown in about the same proportions and management and fertilizer treatments are the same as on Newport loam. Yields of the different crops average about the same as or slightly higher than on that soil.

Newport loam, slope phase.—The slope phase of Newport loam is of very small extent and is not important agriculturally. It occurs in small scattered areas on 10- to 20-percent slopes in the western parts of Tiverton and Little Compton Towns and in some parts of Middletown and Portsmouth Towns in Newport County. Most of the slopes are rather short but as a rule have not been broken or pitted by erosion.

Owing to the sloping relief, these areas are not utilized for cultivated crops, although they have been cleared of stones and trees. Most of the land is utilized for grazing purposes, the production of hay, or is lying idle. The idle areas support a shrub, weed, and grass cover of bayberry, arrowwood, goldenrod, yarrow, broomsedge, and Colonial (Rhode Island) bentgrass.

This soil is characterized by a 4- to 6-inch grayish-brown mellow and friable loam surface soil with small shale and sandstone fragments scattered over the surface. The subsoil is brown or pale yellow-brown loam grading into olive-gray gravelly and gritty light loam. The subsoil varies in depth and rests on dark olive-gray or bluish-gray coarse gravelly partly weathered till at a depth ranging from 18 to 24 inches. The till is fairly compact in place but breaks down easily. In some places bedrock is rather near the surface. This is a good soil for grasses and, owing to the relief and susceptibility to erosion if cleared, it should be utilized only for the production of hay and for pasture. Hay yields from 1 to 2½ tons an acre.

Newport loam, steep phase.—Newport loam, steep phase, also is of very small extent. Only two bodies, one bordering the Sakonnet River in the town of Portsmouth and the other in the western part of the same town, are mapped. This soil is essentially the same as Newport loam, slope phase, except in relief and in being more variable in texture and depth. The slopes range from 20 to 35 percent and are very susceptible to erosion if not managed properly. Both sheet and gully erosion have been active on the unprotected areas, and a few gullies have developed.

Most of this land is utilized for pasture, for which it is best adapted when cleared of trees. Small bodies are in mowing and a few are lying idle.

Newport fine sandy loam.—In cultivated fields, the surface soil of Newport fine sandy loam is grayish-brown mellow friable fine sandy loam 5 to 8 inches thick. Where this soil has been in grass for several years, the surface soil is well matted with small roots and has a friable granular structure. The subsoil is pale yellowish-brown or olive-brown loam or fine sandy loam, firm in place, but mellow and friable. At a depth ranging from 16 to 20 inches below the surface the upper subsoil layer grades into olive-gray, friable, light loam or

fine sandy loam containing considerable gravel and gritty material. The lower subsoil layer rests on partly weathered glacial till from 24 to 30 inches below the surface. In all layers of this soil the brown color is intensified on a freshly cut surface or when the material is pressed between the fingers. Scattered over the surface and throughout the solum are small fragments of shale, sandstone, and other rocks.

This soil occurs in scattered areas in the southern part of Bristol County bordering the shore and in Newport County bordering the shore in the towns of Portsmouth, Jamestown, and Middletown. Probably about 60 percent of the land is under cultivation, and the rest is lying idle or is utilized for grazing. Much of that on Prudence and Conanicut islands is idle, and bayberry, arrowwood, goldenrod, yarrow, sheep fescue, broomsedge, bentgrasses, and dewberries make up the predominating vegetation.

This soil occurs on fairly long and smooth slopes ranging from 3 to 10 percent. Natural drainage is good, and the water-absorbing and water-holding capacities are good, owing to the favorable texture and structure of the surface soil and the fairly compact substratum. The soil works up to a good tilth, is easily managed, and with proper care and fertilization can be built up to and maintained in a fairly productive state. On the more sloping areas some care should be exercised to control surface erosion if the land is planted to such clean-cultivated crops as corn, potatoes, and market-garden crops. These latter areas should be utilized for hay and pasture as much as possible and the less sloping areas for cultivated crops.

Newport fine sandy loam is not so productive as Newport loam for such crops as hay and corn. Potatoes and market-garden crops, especially root crops, yield well with proper fertilization and care. Because of its lighter texture, the fine sandy loam is slightly better drained than the loam, and, therefore, warms earlier in the spring and is better adapted to early vegetables. Hay, silage corn, and vegetables are the more important crops grown on this soil. The different crops receive practically the same fertilizer treatment as on Newport loam. Mixed hay yields from 1 to 2½ tons an acre, silage corn 8 to 14 tons, alfalfa 2½ to 4½ tons, potatoes 200 to 275 bushels, and sweet corn 500 to 1,000 dozen ears.

Newport fine sandy loam, level phase.—Newport fine sandy loam, level phase, occurs on nearly level or very gently sloping relief. This soil is essentially the same in profile characteristics as Newport fine sandy loam. Probably the surface soil averages a little thicker, because the smooth surface is not so subject to sheet erosion. Drainage is good, but surface run-off is not so rapid and the water-holding capacity is slightly higher than in the typical soil.

This level soil is closely associated with Newport fine sandy loam, and the total acreage is about the same. Probably a higher percentage of the land is under cultivation to the same crops and in about the same proportion than on Newport fine sandy loam. Management and fertilizer practices are essentially the same, and crop yields average about the same or a little higher. The idle land supports practically the same vegetation. Part of it is utilized for grazing.

Newport loamy fine sand.—Newport loamy fine sand is not an important soil in this area. Its principal occurrence is on Conanicut

and Prudence Islands. Probably the wind has had an important part in the development of these loamy fine sand areas. At least the surface seems to be greatly influenced by white quartz sand blown in from the nearby shores of Narragansett Bay. The 6- to 8-inch surface soil is grayish-brown mellow loamy fine sand containing a very small quantity of well-decomposed organic matter. Pure white quartz sand is very noticeable in this layer. The subsoil is pale yellowish-brown mellow friable fine sandy loam or loamy fine sand, which grades into gray or olive-gray loamy fine sand or medium sand at a depth ranging from 18 to 24 inches. This material rests on dark bluish-gray coarse gritty glacial till from 30 to 36 inches below the surface. The till is composed largely of materials derived from shales, schist, and sandstone. The surface soil and upper subsoil layer are practically free of shale and other small rock fragments.

The entire area of this soil is free of stone and cleared of trees, but practically all of it is lying idle or is used for grazing. The vegetation consists of bayberry, sumac, broomsedge, poverty oatgrass, and Colonial (Rhode Island) bentgrass. The soil occupies slopes ranging from 3 to 10 percent, and drainage is good to excessive. Owing to its inherent low fertility and low water-holding capacity, this soil is not very productive for the general farm crops. With heavy applications of manure and fertilizer, fair yields of early vegetables could be obtained when sufficient moisture is available.

Newport loamy fine sand and loamy sand seem to be more acid in the surface soil than do the heavier textured Newport soils.

Newport loamy fine sand, level phase.—This soil is closely associated with Newport loamy fine sand, and the total areas of the two soils are about the same. The only difference in the soils is in their relief. Newport loamy fine sand, level phase, occurs in nearly level or very gently sloping areas. A few bodies of this soil are under cultivation to vegetables and sweet corn, and a small acreage is devoted to hay. Most of the land, however, is idle and supports the same vegetation as that growing on Newport loamy fine sand. Part of the idle land is utilized for grazing. Hay yields from ½ to 1 ton an acre, and sweet corn from 300 to 500 dozen ears.

Newport loamy sand.—Newport loamy sand is one of the less extensive soils of the area. It occurs on Prudence Island, in the town of Portsmouth bordering Narragansett Bay, and also in the southwest corner of the town and in the northwest corner of the town of Middletown. It is unimportant agriculturally, owing to its small acreage, low inherent fertility, and droughtiness. The entire area is lying idle and supports a scant vegetation consisting largely of bayberry, sumac, broomsedge, poverty oatgrass, and briers.

The surface soil of Newport loamy sand is grayish-brown loamy sand from 6 to 8 inches thick. The subsoil is pale yellowish-brown incoherent medium loamy sand, which grades into gray loamy sand at a depth ranging from 24 to 30 inches. This material rests on bluish-gray coarse gravelly and gritty till at a depth of 36 to 42 inches. Apparently this soil is influenced more by wind-blown sand than by the underlying glacial till. The surface is free of stone and rock fragments.

Bernardston loam.—Bernardston loam differs from the Newport soils in having a lighter grayish-brown or light-brown surface soil

and in having a yellowish-brown or reddish-brown upper subsoil layer ranging in thickness from 2 to 8 inches. In many places the upper subsoil layer is incorporated with the surface soil in plowing and imparts to the surface a light-brown or light grayish-brown color. The differences mentioned probably result from slightly better drainage and to a lower percentage of shale and slates in the glacial till from which the soil has developed.

The soil in cultivated fields of Bernardston loam is characterized by a 6- to 10-inch light-brown or grayish-brown mellow friable loam surface soil. In wooded areas there is a thin layer of leafmold over a rich-brown mellow loam surface soil about 6 inches thick. The upper part of the subsoil is yellowish-brown or reddish-brown mellow friable loam ranging in thickness from a few inches to 8 inches. This layer has been disturbed in many cultivated fields. The yellowish-brown or reddish-brown layer grades into dingy grayish-brown mellow friable loam, which continues to a depth ranging from 18 to 24 inches. Below this layer is olive-gray friable loam, which becomes darker with depth and grades into bluish-gray or greenish-gray fairly compact but friable partly weathered till at a depth ranging from 26 to 30 inches. The till is composed largely of material from shale, sandstone, and conglomerates. In places the upper part of the till is mottled with yellow, brown, and gray, and it becomes darker and coarser with depth. Small fragments of blue shale, sandstone, and other rocks are scattered over the surface but not in sufficient quantity to interfere with cultivation. The subsoil also contains some small rock fragments, the quantity of which increases with depth.

Bernardston loam is fairly uniform in texture, although in places the texture approaches very fine sandy loam. Throughout the areas of Bernardston loam are bodies of Newport loam which are too small to separate on a small-scale map.

Bernardston loam occurs in the southern part of Bristol County in the towns of Portsmouth and Middletown, Newport County. It is fairly extensive and is one of the most important soils in the area. The relief ranges from gently sloping to sloping, the gradient being from 3 to 10 percent. Most of the slopes are long and smooth. Both surface drainage and underdrainage are good. Owing to the favorable texture and structure, and to the fairly compact substratum, this soil has a comparatively high water-holding capacity, and crops seldom suffer from lack of moisture. With proper management and fertilization the soil can be built up to and maintained in a productive state. Most areas of this soil are large enough to allow the use of tractors and other improved farm machinery. Some of the more sloping areas are subject to sheet erosion under clean cultivation, and these should be handled in a way to reduce erosion to a minimum. This can be accomplished by strip cropping or by utilizing the sloping areas for hay and pasture grasses.

Probably from 80 to 90 percent of this soil is under cultivation. A small acreage is in wood lots, and the rest is idle or is utilized for grazing. Hay, market-garden crops (pl. 1, *C*), silage, corn, potatoes, and sweet corn are the principal crops in the order named.

Small acreages are devoted to alfalfa, red clover, nursery stock, orchard fruits, small fruits, wheat, and field corn. Hayfields usually receive an application of stable manure and from 1 to 2 tons of lime

to the acre when seeded. Some farmers apply from 200 to 400 pounds of commercial fertilizer, but this is not general. Mixed hay yields from 1½ to 3 tons per acre. For alfalfa and red clover higher applications of lime are more general at seeding time and most farmers top-dress with a high phosphorus and potash fertilizer mixture. Alfalfa yields from 3 to 5 tons an acre. Market-garden crops receive, in general, from 1,000 to 2,000 pounds of fertilizer to the acre annually and about 1 ton of lime every 3 or 4 years. A 5–8–7 mixture of commercial fertilizer is most generally used, and 4–8–4, 8–16–16, and other mixtures are used less extensively. The plowing under of rye in the spring is common on market-garden farms. Cabbages yield from 300 to 400 bushels an acre, tomatoes 300 to 500 bushels, string beans 250 to 350 bushels, carrots 400 to 500 bushels, and beets 300 to 400 bushels. Wheat yields 30 to 40 bushels, and field corn 40 to 50 bushels when heavily fertilized. Sweet corn receives about one-half ton of a 5–8–7 mixture with manure and yields 600 to 1,200 dozen ears. Silage corn receives a heavy application of manure and 300 to 400 pounds of 5–8–7, 4–8–4, or 4–12–4 commercial fertilizer. Yields range from 10 to 15 tons an acre. Potatoes are fertilized with about 1 ton of 5–8–7 or 5–10–10 commercial fertilizer, and they yield 250 to 325 bushels an acre. With the exception of one commercial peach orchard, there are very few fruit trees on this soil. The trees in this orchard have made a good growth and are in a healthy condition. Yields probably average around 100 bushels an acre.

Bernardston loam, level phase.—The level phase of Bernardston loam occurs in close association with typical Bernardston loam. It occupies the areas with nearly level to very gently sloping relief. Except in this respect the two soils are essentially the same. Because of the smooth relief, surface run-off is not so rapid as on the more sloping soil and the water-holding capacity is slightly higher. This soil is subject to very little or no sheet erosion even where used for clean-cultivated crops. The surface soil probably averages a little thicker than in the typical soil.

The total acreage of Bernardston loam, level phase, is about the same or a little more than the total acreage of the typical soil. Probably a little higher percentage of more level land is cultivated. It is devoted to the same crops and in about the same proportion as Bernardston loam (pl. 2, *A*). Crop yields are about the same or a little higher; and fertilizer and management practices are essentially the same for the two soils.

One irrigation system (pl. 2, *B*) was noted on this soil, and the owner reported that his yields averaged higher and were more constant than on the same land without irrigation.

Compton loam.—Compton loam has developed from glacial till containing a higher percentage of dark-colored shales and slates than the till from which the Newport soils have developed. The surface soil of Compton loam is much darker than that of Newport loam, contains more chips of shale and slate, and the gradation between the surface soil and subsoil is not well defined. Due to the slow rate at which this dark slaty and shaly material decomposes this soil is shallow compared with the Newport soils.

Compton loam is characterized by a very dark grayish-brown friable heavy loam surface soil from 6 to 8 inches thick. Many shale

and slate chips are on the surface, which has a nearly black, slaty appearance when wet. The surface soil grades into lighter grayish-brown or olive-brown mellow friable heavy loam. On a cut surface or when the material is pressed between the fingers, the brown color is much more pronounced in this layer. The soil material becomes darker and coarser with depth and grades into bluish-black fairly compact but friable gravelly and gritty till at a depth ranging from 15 to 20 inches below the surface. This till is compact in place but breaks down easily when crushed between the fingers, and it becomes darker and coarser with depth. The quantity of gravel on the surface varies from place to place, also in depth. In places the gravel on the surface is very noticeable, whereas, in other places it is of no consequence.

The total acreage of this soil is rather small. It occurs in the northern part of the town of Portsmouth, the southwestern part of the town of Tiverton, and the northwestern part of the town of Little Compton. The relief ranges from gently sloping to sloping, and the slopes range from 3 to 10 percent. Both external and internal drainage are good but not rapid.

All this land is cleared of stones and trees and most of it is cultivated or in pasture. Mixed hay is the most important crop. Silage corn and market-garden crops occupy fairly large areas, and smaller acreages are devoted to sweet corn, potatoes, and wheat. Fertilizer treatments are the same as for Newport loam and Bernardston loam.

Hay yields from 1½ to 2½ tons an acre, silage corn, 8 to 12 tons, wheat 30 to 40 bushels, potatoes 150 to 250 bushels, cabbage 300 to 350 bushels, and sweet corn 600 to 1,000 dozen ears. This soil is not so easily managed as the Newport or Bernardston soils, because there is more gravel on the surface, it is slightly heavier textured, and the soil is very shallow in places. It is well adapted to the production of such crops as hay, silage corn, cabbage, and squash.

From some of the more sloping areas erosion has removed part of the surface soil, and some care should be taken to control erosion on such areas.

Compton loam, level phase.—Except in relief, this soil is essentially the same as Compton loam. It is nearly level or very gently sloping, is subject to little or no erosion, and the surface soil probably averages a little thicker than that of the typical soil. In addition, surface drainage is less rapid, due to the smooth relief, and it has a slightly higher water-holding capacity.

The total area of the level phase is about the same as that of Compton loam, and the same crops are grown on the two soils in about the same proportion. Crops on the two soils receive similar fertilizer treatments. Yields average about the same or a little higher on the level soil.

Tiverton gravelly fine sandy loam.—The Tiverton series is established for the first time in Newport and Bristol Counties, R. I. In the soil survey of Bristol County, Mass., this soil was mapped as Coloma fine sandy loam along the Massachusetts and Rhode Island State line.

The 6-inch surface soil of Tiverton gravelly fine sandy loam in cultivated fields is grayish-brown or brown gravelly fine sandy loam.

In wooded areas there is a thin covering of leafmold on the surface. The subsoil is yellowish-brown mellow and friable fine sandy loam or sandy loam, containing some angular rock fragments. At a depth ranging from 16 to 20 inches, the upper subsoil layer grades into yellowish-gray or olive-gray gravelly and gritty friable sandy loam, which, in turn, rests on gray or bluish-gray coarse gravelly and gritty compact till at a depth of 24 to 30 inches below the surface. The till varies from very compact to slightly compact. It is composed largely of conglomerate and sandstone, with a small percentage of granitic materials. The gravel on the surface consists of angular and flat fragments of conglomerate, sandstone, shale, and granitic rock. In places this soil has a greenish or slaty tinge, in the surface soil and subsoil, which is characteristic of the Newport soils. The yellowish-brown upper subsoil layer, however, is much better developed in the Tiverton than in the Newport soils, and the influence of shale and slate is not nearly so pronounced.

Tiverton gravelly fine sandy loam has developed in scattered areas in the northern part of Bristol County and in the northern part of the town of Tiverton, Newport County. The total acreage is small, and practically the entire area is under cultivation. A few scattered stones of conglomerate and gneiss occur in places, but they do not interfere to any great extent with cultivation. Vegetables, sweet corn, potatoes, hay, and silage corn are the principal crops. Vegetable crops, such as peas, beans, tomatoes, carrots, and beets, and sweet corn, do very well on this soil. The soil is not so well adapted to hay and corn as are the heavier textured Newport soils. Fertilizer treatments are essentially the same on this soil as on the soils previously described. Tomatoes yield from 250 to 350 bushels an acre, string beans 200 to 300 bushels, carrots 500 to 400 bushels, potatoes 200 to 250 bushels, and sweet corn 600 to 900 dozen ears. Hay yields 1 to 2 tons and silage corn, 8 to 12 tons.

Tiverton gravelly fine sandy loam occurs on slopes having a gradient of 3 to 10 percent. Natural drainage is good. Owing to the open and porous character of this soil, the water-holding capacity is only fair, and crops may suffer in places during dry seasons. Erosion does not present a serious problem, but some care in cultivation and cropping practices should be exercised on the more sloping areas.

Tiverton gravelly fine sandy loam, level phase.—Tiverton gravelly fine sandy loam, level phase, differs from Tiverton gravelly fine sandy loam in one essential only, that is, relief. The land is nearly level or very gently sloping. This soil occurs in close association with Tiverton gravelly fine sandy loam, and practically the entire acreage is under cultivation. The same crops are grown in about the same proportion, fertilizer treatments are the same, and crop yields average about the same or a little higher.

Because of the smooth relief, the soil is subject to little or no erosion. Surface run-off is not so rapid and the water-holding capacity is slightly higher than in the typical soil.

Tiverton gravelly loam.—Tiverton gravelly loam occurs in only a few scattered bodies in the northeast and northwest parts of the town of Tiverton. The land is nearly level, and although natural drainage is good it is not rapid. The surface soil is grayish-brown mellow and friable gravelly loam from 6 to 8 inches thick.

The subsoil is pale yellowish-brown mellow loam grading into olive-gray gravelly and gritty loam at a depth ranging from 15 to 18 inches below the surface. The lower subsoil layer rests on bluish-gray compact till at a depth of 24 to 28 inches. The till beneath the loam is more compact than that under the fine sandy loams.

The entire acreage of this soil is under cultivation, principally to hay, silage corn, and sweet corn. A very small acreage is devoted to vegetable crops. With proper care and fertilization, good yields of hay and silage corn are obtained. The soil is retentive of soil moisture and plant nutrients and can easily be built up to a productive state. Hay yields 1½ to 3 tons an acre, silage corn 10 to 15 tons, and sweet corn 600 to 1,200 dozen ears.

Narragansett fine sandy loam.—The 6-inch surface soil of Narragansett fine sandy loam is a grayish-brown mellow and friable fine sandy loam. In areas that have not been plowed for several years this layer is well matted with small roots, and the surface has a weak granular structure. The upper part of the subsoil is a yellowish-brown friable fine sandy loam, which grades into a grayish-yellow gritty and friable lower subsoil layer at a depth of 14 to 18 inches below the surface. The lower part of the subsoil carries some angular rock fragments and rests on dark-gray compact till at a depth ranging from 24 to 30 inches. Yellow, gray, and brown mottlings are common just above the till, which is composed largely of granitic materials. The texture of the surface soil varies somewhat and in places may be very fine sandy loam.

This soil is of small extent. It occurs mainly in the northern and southeastern parts of Block Island. All the land has been cleared and cultivated at one time. Probably 20 percent is under cultivation at present, and the rest supports a vegetation consisting mainly of bayberry, goldenrod, broomsedge, Colonial (Rhode Island) bentgrass, and Kentucky bluegrass. Part of the idle land is utilized for grazing. Hay, field corn, sweet corn, vegetables, and potatoes are the main crops. Sweet corn and vegetable crops are grown for home use and to supply the summer tourist trade on Block Island. Crop yields vary depending on management and the quantity of fertilizer and manure used. The land is capable of producing crop yields comparable with Newport or Tiverton fine sandy loams having similar relief. Commercial fertilizers are not used so extensively as on some soils previously described. Hay yields from 1 to 2 tons an acre, sweet corn 500 to 1,000 dozen ears, potatoes 150 to 250 bushels, and field corn 25 to 35 bushels.

Narragansett fine sandy loam occupies gently rolling to rolling areas. Natural drainage is good, but, owing to the compact substratum, the downward movement of water is retarded to some extent and the soil has a fairly high water-holding capacity. The more rolling areas should be left in grasses for hay or pasture, as such areas are susceptible to erosion if devoted to clean-cultivated crops.

Narragansett fine sandy loam, level phase.—The soil profile of this soil is similar to or identical with that of Narragansett fine sandy loam. The only essential difference is in relief, as the more level soil occupies nearly level to very gently sloping positions. Therefore, surface drainage is not so rapid and the water-holding capacity of the soil is slightly higher. This soil is subject to little or no erosion, because of the smooth relief.

This soil occurs in scattered areas in the southeastern part of the town of Tiverton, the eastern part of the town of Little Compton, and on Block Island, Newport County. The total acreage is small. This soil is closely associated with the stony Narragansett and Gloucester soils. A few scattered stones are found on the surface in places, but they do not interfere appreciably with cultivation.

Practically all of this land is cleared, and a large percentage is under cultivation. Some areas have been idle for several years and are growing up in brush, weeds, and grasses. This soil is slightly superior to Narragansett fine sandy loam for the production of general crops, and with similar care and fertilizer treatments, yields compare favorably with those obtained on Newport fine sandy loam and Tiverton gravelly fine sandy loam. This is the most important soil in the sections where it occurs. Mixed hay and silage corn are the principal crops, and small acreages are devoted to vegetable crops, potatoes, and sweet corn. Yields vary according to management and fertilizer treatments. Hay yields from 1 to 2 tons an acre, silage corn 8 to 12 tons, and potatoes 200 to 250 bushels.

Gloucester fine sandy loam.—Gloucester fine sandy loam is inextensive and is unimportant agriculturally. It occurs in small scattered areas in the southeastern part of the town of Tiverton and the eastern part of the town of Little Compton. It is closely associated with Gloucester stony fine sandy loam. The surface is practically free of stones and boulders.

In cultivated fields Gloucester fine sandy loam is characterized by a light-brown or grayish-brown mellow fine sandy loam surface soil about 6 inches thick. Small angular rock fragments of granite and gneiss are scattered over the surface. The subsoil is yellow or brownish-yellow friable fine sandy loam that grades into grayish-yellow loose and gritty sandy loam or fine sandy loam at a depth of 16 or 18 inches. The lower subsoil layer rests on loose gritty and gravelly gray till at a depth ranging from 22 to 26 inches. The till underneath the Gloucester soils shows little or no compactness contrasted with the compact granitic till of the Narragansett soils.

The relief ranges from gently sloping to sloping, with a gradient of about 3 to 10 percent. Natural drainage is good to excessive as the loose till underneath this soil is conducive to the rapid downward movement of water. This together with the fact that the Gloucester soils have a higher percentage of coarser material throughout, makes them slightly inferior to the Narragansett soils for the growth of general crops.

Hay and silage corn are the principal crops. Hay yields from 1 to 2 tons an acre and silage corn from 8 to 10 tons. Small acreages are devoted to home gardens.

STONY WELL-DRAINED TILL SOILS

The stony well-drained till soils include the stony members of the Gloucester, Narragansett, Tiverton, Bernardston, and Newport series. Of these, the Gloucester soils are the most extensive. The Gloucester soils are inherently the least productive of the group for either forests or farm crops.

These soils are largely in forest or brush. A small percentage of the land is cleared of trees and is used for pasture or is lying idle.

The relief ranges from nearly level to rolling and steep. On a large proportion of the total acreage, however, the relief is favorable for farming operations, but the cost of clearing this land of stone and trees (probably from $100 to $300 an acre, depending on the quantity of stones, trees, and brush), largely prohibits its use for agricultural purposes other than forestry and grazing.

Gloucester stony fine sandy loam.—Gloucester stony fine sandy loam has developed in fairly large areas in the town of Tiverton, in small scattered areas in the northeastern part of the town of Little Compton, and on Block Island, Newport County. Most of this soil supports a second- or third-growth forest cover and brush, consisting mainly of white oak and scrub oak, with some black oak, pitch pine, and chestnut sprouts. The underbrush consists mainly of blueberries, sumac, briers, and bracken. Most of the trees are small and are of little value except for cordwood. A very small percentage of this soil has been cleared of trees, and it is now used largely for pasture. Scattered patches are used for home gardens.

In forested areas there is a thin covering of leafmold on the surface. The 1- to 2-inch surface layer is grayish-brown or light grayish-brown fine sandy loam. In places an ash-gray layer about one-half inch thick lies just beneath the leafmold. The upper part of the subsoil is yellow or light yellowish-brown loose and friable fine sandy loam, which, at a depth ranging from 14 to 18 inches, grades into grayish-yellow loose and gritty fine sandy loam or sandy loam. This material rests on light-gray or yellowish-gray loose gravelly and sandy till at a depth ranging from 24 to 30 inches. This till shows very little or no compaction and is composed largely of granitic materials. Numerous stones and boulders of granite and gneiss are scattered over the surface and throughout the soil mass. The depth to bedrock ranges from a few feet to about 10 feet.

The surface is nearly level, undulating, or gently rolling. Natural drainage is good to excessive.

Gloucester stony fine sandy loam, steep phase.—This soil occurs in a few small bodies in the northeastern part of the town of Little Compton and in fairly large bodies on Block Island. It has developed in areas having either steep slopes or steeply rolling relief.

The areas in the towns of Tiverton and Little Compton are in forest, whereas the areas on Block Island have been cleared of trees and now support a shrub and grass vegetation consisting of bayberry, broomsedge, poverty oatgrass, Colonial (Rhode Island) bentgrass, and goldenrod. On Block Island this soil is utilized for grazing to some extent, but most of it is idle.

More variations in texture and depth occur in the steep soil than in Gloucester stony fine sandy loam. Otherwise, the profile characteristics of the two soils are essentially the same.

Narragansett stony fine sandy loam.—Only a very small proportion of this soil has been cleared of trees. The rest supports a forest growth consisting mainly of red maple, red oak, scarlet oak, white oak, and white pine. The underbrush is mostly highbush blueberry, dangleberry, horsebriers, and summersweet (sweet pepper bush).

Narragansett stony fine sandy loam is fairly extensive in the town of Tiverton and the northeastern corner of the town of Little Compton. With the exception of two small bodies with sloping relief, this

soil has developed in nearly level or gently undulating positions. Natural drainage is good, but, owing to the smooth relief and more compact substratum, drainage is not so good as in the Gloucester soils. The tree growth is much more vigorous than on Gloucester stony fine sandy loam. In wooded areas that have not been disturbed the organic leaf mat is 1 or 2 inches thick over the 2- to 6-inch grayish-brown or dark grayish-brown mellow fine sandy loam surface soil. The upper part of the subsoil is yellowish-brown mellow and friable fine sandy loam, which grades into a grayish-yellow or yellowish-gray loose and gritty fine sandy loam or sandy loam lower subsoil layer at a depth ranging from 12 to 16 inches below the surface. This rests on gray or dark-gray compact but friable till at a depth of 24 or 26 inches. Many granite and gneiss stones and boulders are scattered over the surface and embedded in the subsoil.

Newport stony fine sandy loam.—This soil is similar to Newport fine sandy loam in profile characteristics and in relief. It is not so stony as the stony Gloucester and Narragansett soils, but surface stones, consisting of shale and sandstone, occur in sufficient quantities to interfere with cultivation. The total area is very small. A few small areas are located on Prudence and Patience Islands. These areas have been cleared of trees and probably were cultivated at one time. Except for a small amount of grazing, this land is not used at present. It supports a vegetative cover consisting mainly of gray birch, bayberries, dewberries, broomsedge, goldenrod, and horsebriers.

Newport stony loam, steep phase.—Areas of Newport stony loam having rolling to steep relief occur in small scattered bodies associated with the other Newport soils in both counties. The areas are not excessively stony on the surface, but outcrops of bedrock are common, and the soil in general is shallow and gravelly. The surface soil is brown or grayish-brown gravelly loam to a varying depth. The subsoil is pale yellowish-brown loam. In places it rests on bedrock at a depth of a few inches, and in other places it grades into olive-gray gritty loam that rests on dark bluish-gray till at a depth ranging from 12 to 18 inches below the surface. This soil is partly residual in origin.

Probably 25 percent of the total acreage has been cleared of trees and brush and is used for pasture, which affords fair grazing in places where the brush and weeds are kept out. The rest either supports forest or a growth of shrubs and herbs. The best use for the land is for pasture or for forest.

Bernardston stony loam.—Bernardston stony loam is not extensive. It occurs in scattered areas in Bristol County and in the northern part of the town of Portsmouth in Newport County. The soil profile is the same as that of the other Bernardston soils, and the only essential difference is in the quantity of stone on the surface. The areas are not excessively stony, but the surface stones, consisting of shale and sandstone, occur in sufficient quantity to interfere with cultivation.

About 50 percent of this land is in forests consisting mainly of beech, scarlet oak, red oak, and gray birch, with an undergrowth of blueberry, bayberry, and horsebriers. The rest has been cleared of trees, and the present vegetation consists of shrubs and herbs.

The relief ranges from gently sloping to sloping, and drainage is good.

Tiverton stony gravelly fine sandy loam.—Tiverton stony gravelly fine sandy loam is characterized by a brown or grayish-brown mellow and friable gravelly surface soil from 4 to 6 inches thick. In wooded areas that have not been disturbed, an organic leaf mat 1 or 2 inches thick covers the surface. The upper subsoil layer is yellowish-brown mellow and friable fine sandy loam or sandy loam. It grades into the yellowish-gray gravelly and gritty sandy loam lower subsoil layer, which rests on dark-gray or bluish-gray till varying in compactness at a depth ranging from 22 to 28 inches below the surface. Conglomerate and sandstone stones and boulders are scattered over the surface and embedded throughout the soil mass. Flat and angular fragments of shale, sandstone, and other rocks are numerous on the surface and throughout the soil.

This soil has developed in small areas in the town of Warren, Bristol County, and in the northern part of the town of Tiverton, Newport County. It occurs on 3 to 10 percent slopes, and natural drainage is good. A large percentage of the total area is in forests including about the same species of trees as those growing on Gloucester stony fine sandy loam. The rest of the land is growing up to brush, shrubs, and herbs, except a few very small areas that are cultivated between the rocks. Some of this land and a small percentage of the forest land are utilized for pasture. This soil compares well with Gloucester stony fine sandy loam for the growth of trees and for pasture.

Tiverton stony gravelly fine sandy loam, level phase.—This soil differs from typical Tiverton stony gravelly fine sandy loam in only one respect—relief. It occupies nearly level or gently sloping areas and is closely associated with the typical soil. The total acreage is less than that of the typical soil, but approximately the same proportion of the land is in forest, the same in shrubs and herbs, and the same utilized for grazing. This soil also compares well with Narragansett stony fine sandy loam for pasture or for trees.

Tiverton stony fine sandy loam, steep phase.—This steep soil occupies slopes ranging from about 20 to 30 percent. It occurs in one fairly large body in the northwest corner of the town of Tiverton. The surface soil is more variable in depth and the depth to till or bedrock is more variable than in the Tiverton soils with smoother relief. Otherwise, the steep soil does not differ essentially in profile characteristics from the other Tiverton soils.

Owing to its steepness the best use for this soil is either for forestry or for grazing. The soil is comparable to Gloucester stony fine sandy loam, steep phase.

WELL-DRAINED TO DROUGHTY SOILS OF THE OUTWASH PLAINS

The soils developed on the outwash plains are represented by soils of the Merrimac and Warwick series. The Merrimac soils have developed from water-laid materials consisting mainly of granite, gneiss, and quartz; whereas the Warwick soils have developed from water-laid materials containing a high percentage of shale, slate, sandstone, and schist. All the soils of the group are acid in all

layers, the Warwick soils being slightly less acid, especially in the subsoil layers, than the Merrimac soils. The pH value of the surface soils ranges from 4 to 4.5, and of the subsoils from 4.5 to 5.5. Fairly extensive areas occur in the town of Barrington, and small scattered areas are in other parts of the two counties.

These soils are stone free, easily tilled, and occur on level (pl. 2, *C*) to gently undulating relief. Drainage is good to excessive, depending on the texture and structure of the soil. The texture ranges from very fine sandy loam to loamy sand, and the inherent productivity of the different soil types is closely related to texture and depth. In general, these soils are leached to a greater extent than the till soils; the lighter textured members of the group are highly leached and are very low in plant nutrients. These soils warm early in the spring, are responsive to fertilization, and, therefore, are well adapted to the production of a wide variety of vegetable crops. The supply of moisture is the limiting factor on the sandier soils.

Agriculturally, the Warwick and Merrimac soils with similar texture and depth are very similar; that is, Warwick fine sandy loam and Merrimac fine sandy loam have essentially the same value for the production of crops.

Warwick very fine sandy loam.—Warwick very fine sandy loam is characterized by a rich-brown mellow friable very fine sandy loam surface soil from 6 to 8 inches thick. A few flat shale and slate fragments are scattered over the surface and throughout the surface soil. The upper part of the subsoil is brown or pale yellowish-brown mellow friable loam or very fine sandy loam. It grades into gray or olive-gray very fine sandy loam at a depth ranging from 12 to 16 inches below the surface. This gray layer changes to light olive-gray very fine sandy loam, mottled with brown and yellow, at a depth of about 30 inches and rests on stratified rounded sand and gravel at an average depth of 36 inches. The sand and gravel are composed largely of shale and slate fragments that have been rounded by the action of water. The upper subsoil layer carries a small quantity of gravel, and in the lower subsoil layers the quantity increases with depth. Roots readily penetrate the subsoil layers, and worm holes are numerous.

Included with this soil are a few small areas that carry more gravel throughout, and beds of sand and gravel are reached at a depth of about 24 inches. The total acreage of Warwick very fine sandy loam is less than 1 square mile. Practically all of the land is under cultivation, and it is one of the best general-purpose soils in the area. Drainage is good, but, owing to favorable texture and structure, the water-holding capacity is comparatively high. The soil responds to fertilization, is retentive of applied nutrients, is easily managed, and works up into an excellent seedbed. Erosion is not a problem because of the smooth surface.

The largest body lies east of Sawpowet Point, Tiverton Town, and several smaller areas are in the same vicinity. Silage corn, hay, sweet corn, and cabbage are the principal crops (pl. 2, *C*), but any crops common to this section do well. This soil compares well with the Bridgehampton soils in southern Rhode Island, which are considered the best soils for potatoes in the State. With heavy fertilization and care potatoes yield from 300 to 400 bushels an acre. Silage corn

yields from 10 to 14 tons to the acre when heavy applications of manure are made and from 200 to 300 pounds an acre of commercial fertilizer are used. Hay yields 1 to 2½ tons an acre and sweet corn from 800 to 1,200 dozen ears, when the land is fertilized with about 1,000 pounds of a 5–8–7 commercial fertilizer. Cabbage yields from 250 to 350 bushels an acre. Most of the other vegetables yield as well or better on this soil than on any other soil in the area.

Warwick fine sandy loam.—Warwick fine sandy loam is more extensive than Warwick very fine sandy loam. Several good-sized bodies lie in the northwestern and southern parts of the town of Barrington, and small scattered areas are in other parts of the two counties, near or bordering Narragansett Bay, Mount Hope Bay, and the Sakonnet River.

The 4- to 6-inch surface soil consists of grayish-brown or brown mellow friable fine sandy loam. A few flat shale and sandstone fragments are scattered over the surface and throughout the surface layer. The upper subsoil layer is light yellowish-brown mellow fine sandy loam. It grades into a lower subsoil layer of olive-gray light fine sandy loam or sandy loam at a depth of 18 to 20 inches below the surface. With depth, this material becomes lighter in texture and contains more gravel. It rests on dark-colored stratified sand and gravel at a depth ranging from 24 to 28 inches. The surface soil and subsoil layers are open and porous, and roots penetrate them readily. The land is level to gently undulating, and drainage is good. During extremely dry seasons crops sometimes suffer from lack of moisture, because of the moderate water-holding capacity and fairly rapid internal drainage. Warwick fine sandy loam is more easily leached of plant nutrients and organic matter and is not so retentive of applied nutrients as Warwick very fine sandy loam.

Probably 50 to 60 percent of this soil is under cultivation; large estates, summer cottages, residential and business buildings occupy a considerable acreage, and the rest of the land is idle or in forests. The abandoned areas support a grass cover of broomsedge, poverty oatgrass, and sheep fescue, together with much haircap moss and cinquefoil.

Warwick fine sandy loam is very easy to cultivate and is responsive to fertilization and care. Hay, sweet corn, and vegetables are the main crops. Small acreages are devoted to silage corn, alfalfa, potatoes, apple orchards, and small fruits. The land for vegetable crops and alfalfa is heavily fertilized and limed; that for sweet corn and potatoes also is heavily fertilized. Hay yields from 1 to 1½ tons to the acre, silage corn 8 to 10 tons, alfalfa 2 to 3 tons, sweet corn 500 to 800 dozen ears, tomatoes 275 to 350 bushels, potatoes 150 to 250 bushels, string beans 200 to 250 bushels, carrots 300 to 400 bushels, and beets 300 to 350 bushels. With irrigation yields could be increased, especially in dry years, but none of this soil is irrigated.

During the course of the survey, one commercial apple orchard was noted on this soil. The trees appeared only fair, and the yields varied from 50 to 200 bushels an acre, according to the care given the orchard.

Warwick gravelly fine sandy loam.—Areas of Warwick gravelly fine sandy loam carry more gravel in the surface soil and subsoil and are shallower over beds of sand and gravel than are the areas of Warwick fine sandy loam. The 4- to 6-inch surface soil is brown or

grayish-brown gravelly fine sandy loam. The subsoil is yellowish-brown mellow fine sandy loam grading into pale-yellow fine sandy loam directly overlying stratified sand and gravel at a depth ranging from 12 to 18 inches below the surface. The subsoil contains considerable shale, sandstone, and quartz gravel. The relief is level to gently undulating, and natural drainage is good to excessive. This soil is much more droughty than Warwick fine sandy loam.

Warwick gravelly fine sandy loam occurs in the town of Barrington, where it is closely associated with Warwick fine sandy loam. All the land has been cleared and probably all was cultivated at one time. At present, about 10 percent is devoted to vegetables and hay. Yields are lower than on Warwick fine sandy loam, but they compare well with yields on Warwick sandy loam. A rather large acreage of this soil is in building sites, and the rest is lying idle or is used for pasture. On the abandoned or idle areas the vegetation consists mainly of bayberry, broomsedge, poverty oatgrass, Colonial (Rhode Island) bentgrass, dewberries, and cinquefoil.

Warwick sandy loam.—Warwick sandy loam is not extensive in area. It has developed in a few small scattered areas in the towns of Barrington and Warren, on Prudence Island, and in a fairly large body in the extreme northern end of the town of Portsmouth.

In cultivated fields the 4- to 6-inch surface soil is grayish-brown loose friable sandy loam containing a small quantity of shale and quartz gravel. The upper part of the subsoil is light yellowish-brown sandy loam or light sandy loam that passes into yellowish-gray sandy loam or loamy sand at a depth of 16 or 18 inches below the surface. The lower part of the subsoil carries a small quantity of flat and rounded gravel, and it rests on loose incoherent coarse sand and gravel at a depth ranging from 24 to 30 inches.

Practically all of this soil has been cleared and at one time was cultivated. At present, however, less than 25 percent is under cultivation. The remainder is in building sites, a golf course, or idle. The idle areas support about the same vegetation as the idle areas of Warwick gravelly fine sandy loam. With the exception of one commercial apple and peach orchard, the cultivated land is devoted to vegetable crops, sweet corn, and hay. The apple and peach trees are fertilized with a complete fertilizer, and lime is added occasionally. The trees yield well, and the fruit has a good color. Yields of other crops vary considerably from year to year, depending on the amount and distribution of rainfall, the fertilization, and the care with which they are managed. With irrigation and heavy applications of fertilizer and manure, and lime every 3 or 4 years, good yields of market-garden crops and sweet corn could be obtained every year. With irrigation, two or more crops could be grown on the land each year.

Merrimac fine sandy loam.—In cultivated fields the surface soil of Merrimac fine sandy loam is brown or grayish-brown mellow fine sandy loam about 6 inches thick. Where this soil has not been disturbed in wooded areas, a leaf mat from 1 to 2 inches thick covers a rich-brown mellow friable fine sandy loam. The upper subsoil layer is light yellowish-brown firm, but mellow and friable, fine sandy loam which grades into a grayish-yellow loose friable gritty sandy loam lower subsoil layer at a depth of 18 or 20 inches. This material

rests on gray or yellowish-gray incoherent coarse sand and rounded quartz gravel at a depth ranging from 24 to 30 inches. The surface soil contains a small quantity of gritty material and some rounded gravel in places. Nowhere is the quantity of gravel sufficiently large to interfere with cultivation.

The total acreage of Merrimac fine sandy loam is less than 1 square mile. Several small bodies occur in the vicinity of Adamsville, in Newport County and north of Warren, Bristol County. This soil is essentially the same as Warwick fine sandy loam as to agricultural value. The texture, structure, depth, content of organic matter, relief, and drainage are practically the same in both soils. Probably Warwick fine sandy loam is slightly less acid in the subsoil.

Most of Merrimac fine sandy loam is under cultivation. Vegetables, sweet corn, and hay are the principal crops. Fertilization treatments are the same and yields are about the same or slightly less than on Warwick fine sandy loam.

Merrimac sandy loam.—Merrimac sandy loam occurs in the northern part of the town of Warren and several fairly large bodies have developed in the town of Barrington. This soil has essentially the same profile characteristics as Merrimac fine sandy loam, except in texture and structure. It is coarser textured and more open and porous throughout. Little or no gravel is present above a depth ranging from 24 to 30 inches, and in most places the substratum consists of beds of coarse gray and yellow sand, with very little gravel. Because of the loose open structure of both the surface soil and subsoil, drainage is good to excessive and the moisture-holding capacity is comparatively low. Fertilizer, lime, and manure are rapidly leached out of this soil. Crop yields are somewhat uncertain, owing to droughts, and they average lower than on Merrimac fine sandy loam.

Probably from 40 to 50 percent of this soil is used for cultivated crops and orchard fruits. The remainder is in building sites and abandoned fields or supports a scrubby forest growth. The predominating vegetation on the abandoned areas consists of broomsedge, gray birch, pitch pine, poverty oatgrass, and haircap moss. The wooded areas support a growth consisting mainly of white oak, scrub oak, and pitch pine, with some gray birch, scarlet oak, blueberry, and sweetfern.

Market-garden crops, sweet corn, and orchard fruits are the main crops. Several small areas of asparagus were noted on this soil. Peach trees do well with care and liberal fertilization. The color of the fruit is very good. The apple trees noted were off-colored and the growth was not vigorous. Yields of market-garden crops, sweet corn, and other crops vary greatly, depending on the supply of moisture, fertilization, and care. In general, crop yields are essentially the same as on Warwick sandy loam.

None of this soil is irrigated, but on Merrimac sandy loam in other parts of Rhode Island and in Massachusetts, with irrigation and heavy applications of fertilizer and lime, yields are fairly high and uniform. The fertilizer most commonly used on these irrigated farms is 1,500 to 2,000 pounds of a 5–8–7 mixture to the acre. Two or three crops are grown on the same land each year. Some farmers apply lime every year, and others every 2 to 4 years. Sweet corn

yields 800 to 1,000 dozen ears to the acre, tomatoes 300 to 500 bushels, carrots 400 to 600 bushels, beets 300 to 500 bushels, lettuce 500 to 700 crates, lima beans 200 to 250 bushels, peppers 600 bushels, melons 50 to 450 bushels, spinach 600 to 800 bushels, and cabbage 300 bushels under irrigation.

Merrimac loamy sand.—Merrimac loamy sand is characterized by a yellowish-brown loose loamy sand surface soil about 4 inches thick. In wooded areas there is a thin covering of leafmold on the surface. The subsoil is yellow loamy sand or sand, which becomes lighter in texture and color with depth and rests on yellowish-gray or gray coarse sand at a depth ranging from 24 to 30 inches below the surface. The substratum contains a small quantity of rounded pieces of gravel in places, but the material is predominantly coarse sand.

Merrimac loamy sand occurs in the northern part of the town of Barrington, closely associated with Merrimac sandy loam. It is not extensive and is unimportant agriculturally. Owing to the loose open structure, drainage is excessive. The soil is highly leached of plant nutrients and organic matter, and applied nutrients in the form of commerical fertilizer, lime, or manure are rapidly leached out.

A very small proportion of this soil is under cultivation. The rest is in building sites, abandoned fields, or supports a scrubby forest cover consisting mainly of scrub oak. The underbrush consists mainly of blueberries, sweetfern, and wild-indigo. Abandoned fields support the same vegetation as abandoned areas of Merrimac sandy loam. Most of the cultivated land is used for vegetables and sweet corn. A few small apple orchards were noted on this soil, but the trees were small and off-colored. Because of the low inherent fertility and droughty character of the soil, yields of vegetables and sweet corn generally are low and uncertain. With irrigation and heavy applications of fertilizer, satisfactory yields of certain vegetable crops and sweet corn could be obtained, but the returns probably would not justify the cost of irrigation.

DROUGHTY SOILS OF THE KAMES

The soils of the kames have developed on hummocky and uneven relief and are associated with the Warwick soils of the outwash plains. Quonset gravelly fine sandy loam is the only soil in this group. It has developed from stratified sand and gravel deposits consisting largely of shale, sandstone, and conglomerate materials; and it is shallow, gravelly, and excessively drained.

Quonset gravelly fine sandy loam.—The surface soil consists of grayish-brown mellow friable gravelly fine sandy loam from 4 to 6 inches thick. The subsoil is pale yellowish-brown loose friable gravelly and gritty sandy loam, which becomes lighter in color and texture with depth. This material rests on loose incoherent stratified sand and gravel at a depth ranging from 12 to 18 inches. The deposits of sand and gravel vary in thickness. The soil is variable in depth to gravel, also in the quantity of gravel on the surface. In places beds of sand and gravel are very near the surface. All layers are acid. The pH value of the surface soil ranges from 4 to 5 and of the subsoil layers from 5 to 5.5.

Areas of Quonset gravelly fine sandy loam are most common in the town of Barrington and on Prudence Island. Small scattered areas occur in other parts of the area. On account of the hummocky or uneven relief and the open and porous structure of the surface soil and subsoil, this soil is excessively drained and highly leached. The best use for the land, other than for building sites, is for grazing and forestry purposes. Probably about 10 percent of the total acreage is used for the production of hay or for grazing. If the weeds and brush are kept out, this land furnishes fair grazing in spring and early summer. Hay yields from ½ to 1 ton an acre. The remaining 90 percent of the soil is in building sites, idle land, or in scrubby forest growth. The idle or abandoned areas support a shrub and herb vegetation consisting mainly of bayberry, goldenrod, broomsedge, and Colonial (Rhode Island) bentgrass. In forested areas the predominating tree growth consists of white oak, gray birch, pitch pine, and wild cherry, and the underbrush is sumac, bayberry, sweetfern, and poison-ivy.

Included areas having a gravelly sandy loam texture are more porous and open in structure and therefore more subject to leaching than the finer textured areas of this soil. These sandy areas occur in the northern part of the town of Portsmouth.

Numerous gravel pits occur in this soil. The gravel in the substratum is used extensively for concrete work and for road building. In general, this soil is more valuable as a source of gravel for road-building material than for agriculture.

IMPERFECTLY DRAINED AND POORLY DRAINED SOILS

This group includes the imperfectly drained and poorly drained soils associated with the till soils and the poorly drained soils associated with the soils of the outwash plains. Because of their topographic position or of some characteristic of the soil, surface drainage, subsurface drainage, or both have been restricted to such an extent as to greatly influence crop production and land use. The imperfectly drained soils are mapped as phases of the Newport and Compton soils; the poorly drained soils are members of the Mansfield, Whitman, and Scarboro series.

The imperfectly drained soils are utilized in a small way for the production of silage corn and hay but are used mostly for pasture. The poorly drained soils are largely in forest or pasture. The imperfectly drained soils occur in slight depressions within areas of the well-drained soils or in narrow strips between the well-drained and the poorly drained soils. Subsurface drainage is so restricted that the subsoils are mottled and waterlogged during wet seasons. The poorly drained soils occur in depressions, along small streams and drainageways and around springs. The dark surface soils overlie waterlogged mottled, gray, yellow, and rust-brown subsoils.

The Mansfield soils are associated with the Newport, Bernardston, and Tiverton soils in the shale, conglomerate, and sandstone areas. The Whitman soils occur in granitic areas with the Gloucester and Narragansett soils. The Scarboro soils are associated with the stone-free Merrimac and Warwick soils. In the soil survey of Bristol County, Mass., these latter soils were included in the Sutfield series.

Newport loam, imperfectly drained phase.—This soil is characterized by a dark-brown mellow heavy loam surface soil about 6 inches thick. A small quantity of flat shale and sandstone fragments are scattered over the surface and throughout the surface soil. The subsoil, to a depth of 10 or 12 inches, is brown or pale yellowish-brown loam with an olive tinge. The lower part of the subsoil is olive-gray, mottled or streaked with yellow and brown, gritty loam. It rests on dark bluish-gray compact but fairly friable till at a depth of about 24 inches. The till is composed largely of shale, conglomerate, and sandstone materials.

The relief is nearly level or gently sloping, as most of this soil occurs in slight depressions or in narrow strips bordering the poorly drained Mansfield soils. Surface drainage is only fair, and subsurface drainage is imperfect. The material in all layers is acid. Most areas of this soil are nearly free of surface stone, although there are a few stony areas in Bristol County.

Newport loam, imperfectly drained phase, occurs in small scattered areas in both counties and is associated with the Newport soils. The total acreage is not very large, and the soil is not important agriculturally. Probably between 40 and 50 percent is cleared of trees, brush, and weeds and is used for hay, pasture, and corn. Hay, which occupies the largest acreage, yields from 1 to 2½ tons an acre depending on the season and fertilization. This soil furnishes good pasture if kept free of weeds and brush. Silage corn yields from 8 to 14 tons an acre depending on the season and care. During wet seasons corn does not do well. With artificial drainage this soil could be used more extensively for corn and for certain other crops. The uncleared areas support a dense growth of trees, briers, shrubs, and herbs.

Compton loam, imperfectly drained phase.—This soil is closely associated with the well-drained Compton loam. The 6-inch surface soil consists of dark-brown or black heavy loam or silt loam and contains many shale and slate chips. The subsoil is olive-gray, mottled or streaked with yellow and brown, heavy loam, which becomes darker and more highly mottled with depth. The subsoil also contains more gravel and gritty material as depth increases and rests on compact bluish-black gritty and gravelly till composed largely of shale and slate at a depth ranging from 18 to 24 inches below the surface. This soil is darker, slightly less acid, and contains more gravel throughout than does Newport loam, imperfectly drained phase.

It occurs in slight depressions or in narrow strips between the well-drained and poorly drained soils. The relief is nearly level to very gently sloping, and drainage is imperfect. All the land is practically stone free. A very small proportion of it is cleared of brush and weeds and is used for the production of hay or for pasture. Hay yields from 1 to 2½ tons an acre, and this soil furnishes good grazing even during dry seasons. The idle or brushy areas support a dense growth of red maple, redcedar, arrowwood, bayberry, hardhack spirea, horsebriers, sedge grass, Colonial (Rhode Island) bentgrass, Kentucky bluegrass, and sweet vernalgrass. These areas provide good grazing in places where the brush and weeds are not too thick.

Mansfield silty clay loam.—The 6-inch surface soil consists of dark grayish-brown or black silty clay loam. In places there is a thin

covering of mucklike material over the surface. The surface soil generally is wet and plastic, but when dry it cracks and becomes hard. The subsoil is gray or dark-gray, mottled or streaked with yellow and brown, silt loam, which becomes lighter in color and more gritty with depth. It has a noticeable bluish-green cast in places and is underlain, at a depth of about 24 inches, by a bluish-gray coarse gravelly compact till composed largely of shale, slate, and sandstone materials. This soil is acid in all layers. The pH value of the surface soil ranges from 4.5 to 5.5, and the subsoil is slightly less acid.

This soil occurs in level or gently sloping areas, generally occupying depressions or narrow bodies along the drainageways. Natural drainage is poor, and the soil is waterlogged part of the time. This is the most extensive Mansfield soil and occurs in small areas associated with the Newport and Tiverton soils in both counties.

Areas of this soil are practically free of large surface stone. The land is used almost exclusively for pasture and for woodland. Probably 20 percent of the total acreage has been cleared of trees, brush, and weeds, and it supports a grass cover consisting mainly of sedge, Colonial (Rhode Island) bentgrass, Kentucky bluegrass, and sweet vernalgrass. These areas furnish good pasture during the summer. With drainage this soil could be used for hay, corn, and certain other cultivated crops. The remaining 80 percent of this soil either supports a forest growth consisting of red maple, black tupelo (sour gum), elm, eastern redcedar, alder, swamp white oak, yellow birch, sumac, arrowwood, and horsebriers, or a scattered growth of some of the trees mentioned with an undergrowth of shrubs and herbs. A large percentage of these areas is also pastured, and their value for grazing depends on how thick the trees, shrubs, and herbs are. Without artificial drainage the best use for this soil is either for grazing or for forestry.

Mansfield stony silty clay loam.—Mansfield stony silty clay loam is similar in profile characteristics to Mansfield silty clay loam. Shale, conglomerate, and sandstone boulders and stones are scattered over the surface and embedded in the soil. This soil is not so extensive as Mansfield silty clay loam, but it occurs in small scattered bodies closely associated with that soil. It occupies the same topographic positions, and drainage is about the same or a little more retarded, owing to the presence of stones. This soil supports the same vegetation and is utilized for grazing and for forestry. Because of the stone content it has a lower potential value for agricultural purposes than Mansfield silty clay loam.

Mansfield silt loam.—Mansfield silt loam is characterized by a dark grayish-brown or nearly black silt loam surface soil about 6 inches thick. The surface soil is mellow and friable when dry, and it is slightly plastic when wet. In places a thin layer of organic matter covers the surface. The subsoil is olive-gray, mottled with yellow and brown, silt loam, which becomes more highly mottled and slightly lighter in texture with depth. This rests on bluish-gray coarse gravelly till at a depth ranging from 24 to 30 inches. This soil is practically free of large surface stone. In places a few stones are scattered over the surface, and small slabs of shale and other rock fragments are common.

Mansfield silt loam is of small extent. It occurs in scattered areas in the town of Middletown and the southern part of the town of

Portsmouth. A fairly large body is in the extreme southwestern part of the town of Little Compton. The relief is nearly level or gently sloping as the soil occupies slight depressions or narrow depressed areas along drainageways. Drainage is poor, and the soil is not used for cultivated crops. A very small percentage is used for hay, and the remainder is used for pasture or is in forest. Areas of this soil support the same type of vegetation as Mansfield silty clay loam. When kept free of brush and weeds, the pastures are fairly good during the summer without the use of fertilizer. Without artificial drainage this soil is best suited for grazing or for forestry.

Mansfield loam.—Mansfield loam is most commonly associated with the lighter textured Newport and Tiverton soils in both counties. It occupies the same topographic positions as the other Mansfield soils, and it is also poorly drained and waterlogged part of the time. The surface soil consists of a dark-brown or nearly black loam or light loam underlain by gray or olive-gray, mottled with yellow and brown, loam or sandy loam. The material in all layers is acid. The surface is nearly free of stones, but small angular rock fragments are scattered over the surface and throughout the soil.

Because of poor drainage this soil is also used only for pasture and for forest. Areas that are fairly free of brush and weeds provide good grazing during the summer. In open areas the predominating vegetation consists of bayberry, hardhack spirea, arrowwood, goldenrod, sedge, Colonial (Rhode Island) bentgrass, Kentucky bluegrass, and sweet vernalgrass. In forested areas the predominating vegetation consists of red maple, black tupelo (sour gum), gray birch, swamp white oak, elm, alder, arrowwood, sumac, horsebriers, and poison-ivy. Mansfield loam is slightly less productive than the heavier soils for grasses and trees, owing to the higher content of coarse materials.

Mansfield stony loam.—Mansfield stony loam differs from Mansfield loam only in the quantity of stones and boulders on the surface. These areas, in general, are not excessively stony as compared to some of the Whitman soils. Mansfield stony loam is utilized also for pasture and for forestry, and the vegetation is essentially the same as that on Mansfield loam. This soil occurs in small areas associated, for the most part, with the lighter textured Newport and Tiverton soils.

Whitman stony loam.—Whitman stony loam is associated with the Gloucester and Narragansett soils in the town of Tiverton and the northeastern part of the town of Little Compton. It occurs in small basinlike areas at the heads of streams, in narrow bands around areas of muck, or in narrow strips along the drainageways. Natural drainage is poor, and water stands on the surface in wet seasons.

The 6-to 8-inch surface soil of Whitman stony loam is very dark grayish-brown or nearly black slightly plastic loam containing considerable organic matter. In places there is a thin layer of mucky material on the surface. The subsoil is gray or yellowish-gray mottled loam that becomes lighter textured with depth. The lower part of the subsoil is highly mottled with rusty brown and yellow, and at a depth ranging from 24 to 30 inches it rests on gray or dark-gray fairly compact coarse gritty till, which is composed largely of granite, gneiss, and other crystalline rock materials. All layers of this soil are acid—more acid than in the Mansfield soils.

Whitman stony loam varies from medium stony to very stony both in the surface soil and subsoil. In places the stones are very thick on the surface, whereas on a few small areas most of the stones have been removed from the surface. Most of this soil is covered with forest consisting mainly of red maple, elm, alder, gray birch, and swamp white oak. Sumac, summersweet, and horsebriers comprise the undergrowth. A few small areas are partly cleared of trees and brush and are used for pasture.

The cost of draining and clearing this land of stones and trees prohibits its use for other purposes than forestry and grazing. It would be very difficult to drain part of this soil because of the quantity of stone and the slight depth to bedrock.

Whitman silty clay loam.—Whitman silty clay loam occurs only in a few small bodies on Block Island. These bodies occupy small depressions or pot holes and are practically stone free. The surface soil consists of very dark brown or black fairly plastic silty clay loam. It overlies a gray or yellowish-gray mottled heavy loam subsoil. Natural drainage is poor, and water stands on the surface in wet seasons. These areas support a shrub and grass cover consisting mainly of bayberry, hardhack spirea, sedge, Colonial (Rhode Island) bentgrass, and sensitive fern. Grazing is the only purpose for which this soil is utilized at present.

Scarboro loam.—Scarboro loam is variable in texture, structure, and color. In general the surface soil is dark-gray or nearly black mellow loam from 4 to 8 inches thick. It is sticky when wet. The surface is free of stone. In undisturbed places there is a layer of partly decomposed organic matter from 1 to 3 inches thick on the surface. The upper part of the subsoil is rust-brown or brown slightly cemented sandy loam or fine sandy loam to a varying depth. In exposed cuts this layer is fairly hard, but it breaks down readily when crushed. In most places the lower part of the subsoil consists of alternate layers of gray and yellowish-gray saturated incoherent sand with rust-brown mottlings or streaks. At a depth ranging from 24 to 30 inches the material is yellowish-gray stratified sand and gravel with slight cementation in places.

The surface soil varies from light loam to heavy loam or silt loam. In places just beneath the surface soil there is a light-gray highly leached layer. The rust-brown slightly cemented layer is missing in places, and the subsoil is gray loam or sandy loam, mottled with rust brown and yellow. This soil is strongly acid in all layers.

Scarboro loam occupies poorly drained areas on the outwash plains. It is associated with the Warwick and Merrimac soils. The land is nearly level or slopes gently toward the drainageways. Water stands on the surface in wet seasons, and the subsoil is waterlogged most of the time.

The total acreage of this soil is very small. It occurs only in the northern part of the town of Barrington. A very small percentage of the land has been cleared of trees and brush, and most of this is used for pasture, with a small strip here and there planted to vegetables or sweet corn. Yields of cultivated crops are low, but the cleared areas provide fair grazing during the summer. The wooded areas support a dense growth of red maple, swamp white oak, yellow birch, gray birch, shadbush, summersweet, horsebriers, and highbush blueberries.

Clearing and draining this land would require less time and expense than clearing and draining either the Mansfield or the Whitman soils, because of the absence of stones and the loose and open substratum. If the land were cleared, however, it would require heavy applications of lime for the successful production of most crops. Some areas have been drained in order to control mosquitoes, but no attempt has been made to reclaim such areas for agriculture.

Scarboro fine sandy loam.—Scarboro fine sandy loam is essentially the same as Scarboro loam except in texture. The surface soil is dark grayish-brown friable fine sandy loam or sandy loam. The subsoil is coarser throughout than the subsoil of Scarboro loam but has the same variations in color.

Scarboro fine sandy loam is inextensive. It occurs in small areas in the town of Barrington and the northwest corner of the town of Warren. It has developed in slight depressions or along small drainageways. Natural drainage is poor but is slightly better established than in Scarboro loam. Practically none of this soil is used for cultivated crops. A few small areas are used for the production of hay, and the rest is used for pasture or is in forests. Areas that have been cleared of trees and brush provide fair grazing. The forested areas support the same type of vegetation as the forested areas of Scarboro loam.

MISCELLANEOUS LAND TYPES

The group of miscellaneous land types includes the scattered areas of muck and peat, with a shallow phase; peat, salt-marsh phase; tidal marsh; alluvial soils, undifferentiated; dune sand; coastal beach; rough stony land; made land; and unclassified city land. None of these land types is of agricultural importance for cultivated crops. The best use of them under present conditions is for forestry, grazing, building sites, and recreational purposes.

Muck and peat.—The muck and peat areas are composed of plant remains that have accumulated in former ponds, in depressions, and along the borders of sluggish streams. These areas differ considerably from place to place in depth, degree of decomposition, and character of the material. As mapped, muck and peat include deposits of organic matter that is fairly well decomposed on the surface but mostly in a raw or partly decayed condition in the lower part. Most of these deposits are more than 3 feet thick.

The surface layer consists of dark-brown or black fairly well decomposed organic matter from 6 to 15 inches thick. This material has a slimy or slick feel when wet. In places there is very little evidence of the original leaf litter and woody material; whereas in other places partly decayed leaves, wood, or fibrous plant remains are evident. Below this layer the material is brown or dark-brown partly decomposed remains of trees and plants. This material varies in color and degree of decomposition, depending somewhat on the character of the material. It is light in weight, spongelike in places, saturated with water, and continues to a depth of 3 feet or more below the surface. Water stands on the surface of the ground most of the year. These areas are strongly acid throughout.

Four fair-sized bodies of muck and peat occur in the town of Tiverton and a few small, widely scattered bodies are in other parts of the

two counties. None of these areas is drained; so they are not used for cultivated crops or cranberries and are used very little for grazing. Most of this land supports a second- or third-growth forest consisting mainly of red maple, gray birch, yellow birch, alder, willow, Atlantic white cedar, and black tupelo (sour gum), with an undergrowth of shrubs and herbs consisting of briers, and skunkcabbage. In small areas where water stands most of the year the vegetation consists chiefly of coarse grasses and cattails.

It is not likely that any of this land will be drained and reclaimed for agriculture in the near future. Adequate drainage would be very difficult in most areas, and the returns from cultivated crops would not justify the cost of drainage.

Muck and peat, shallow phase.—The shallow areas of muck and peat differ from typical muck and peat in that the deposit is thin over mineral soil and is slightly better decomposed throughout. The surface is dark-brown or nearly black well-decomposed organic matter containing a small quantity of mineral soil in places. This material varies in thickness and grades into brown or dark-brown partly decomposed material consisting of leaves, woody material, and fibrous plant remains. This material, in turn, rests on gray, mottled with yellow and rust-brown, mineral soil at a depth ranging from 24 to 36 inches. This mineral soil ranges in texture from fine sand to coarse loam. All layers of shallow muck and peat are strongly acid.

This land type occupies small depressions, narrow bands around areas of deep muck and peat, and narrow strips bordering drainageways. It occurs in small scattered areas over the two counties. Most of this land supports a forest growth essentially the same as that growing on deep muck and peat. Practically none of the land is under cultivation, and very little is utilized for grazing. Areas of shallow muck and peat would be less difficult to drain than the deep areas. Under present economic conditions, however, the cost of draining these areas probably would not be justified.

Peat, salt-marsh phase.—The salt-marsh phase of peat is characterized by a brown or dark-brown fibrous slightly decomposed surface layer grading into darker colored coarse fibrous peaty material, which continues to a depth of 4 feet or more. This material varies somewhat in color and degree of decomposition from place to place. It is uniformly coarser throughout than the muck and peat areas, and no leaves or woody material are evident.

Peat, salt-marsh phase, is not extensive and has no agricultural importance. Areas of this type of peat are widely scattered along the coast line of the two counties, the largest being near Sapowet Point, Tiverton Town. The land is slightly better drained than tidal marsh, though water stands on or near the surface throughout the year. The material is spongy and shaky at all times. The vegetation consists largely of coarse saltgrass and eelgrass. When cut this grass has little value except for bedding livestock.

Tidal marsh.—Tidal marsh includes the flat marshy areas, adjacent to or near the coast line, that are subject to regular tidal inundation. These areas consist of shallow tidal flats, which are exposed to the air during low tide and are covered with water at high tide. Tidal marsh occurs in small as well as fairly large bodies along the shores of the Atlantic Ocean, the bays, and the larger rivers in the two counties.

The surface layer consists of a brown fibrous mat of sedge and grass roots, with some sand intermixed. Below this layer there is, in most places, a dark-gray sandy layer that is fairly firm in place but loose and friable when broken up. This layer gradually changes to coarse gray loose sand at a depth of about 2½ feet. Tidal marsh is the result of the mingling of the coastal beach sand washed or blown over the tidal flats and mixed with finer sediments and the subsequent growth and partial decay of the coarse grasses which form the present cover. The vegetation consists of saltgrass, eelgrass, and sedges, and the stand is thick and fairly tall in most places.

Alluvial soils, undifferentiated.—Areas of alluvial soils, undifferentiated, represent overflow land, which is variable in texture, color, and stoniness. Most of the land is poorly drained. It occurs in narrow strips along fairly rapid flowing streams and is subject to frequent overflows. The surface layer consists of dark-brown or almost black sandy loam or loam containing a fairly large quantity of organic matter. The subsoil is dark gray, mottled with brown, yellow, and drab. In places the surface layer consists of a series of gray, dark-gray, and brown layers of recent alluvium. Some areas of this soil are stone free and other areas have a few stones scattered over the surface and embedded in the soil.

This land type is very inextensive and unimportant agriculturally. A few scattered areas are in the towns of Middletown, Tiverton, and Little Compton. They are utilized for forestry and for grazing purposes.

Rough stony land.—Rough stony land includes areas having steep relief accompanied by many outcrops of solid rock and large boulders. Because of the relief and stoniness this land is unsuited for cultivation and is of very little value for grazing. These rough stony areas occur southwest and east of Newport, south of Jamestown, and in the west-central part of the town of Tiverton. The total acreage is not very large.

Many large estates are located on this land southwest of Newport and south of Jamestown, as these areas are near the shore and present excellent sites for summer homes. Here this land demands a very high price because of its favorable location. Rough stony areas in other parts of the county support a forest cover consisting of redcedar, red oak, black oak, white oak, beech, gray birch, and white pine, with an undergrowth of highbush blueberry and horsebriers. The soil material in the rough stony areas varies according to the soil types with which it is associated. It consists principally of Gloucester material, together with some Newport material. Most of the rock outcrops and boulders consist of granite and granite gneiss, and there is a small quantity of conglomerate, shale, and schist.

Coastal beach.—Coastal beach includes the level sandy fringe, ranging from 50 to 200 feet in width, along the shore line in both counties. This material was deposited by wave action. Most of the fine material has been removed, leaving the sand assorted to some extent. This land may be covered with water at high tide or during storms. Coastal beach supports no vegetation and is of value only for recreation purposes. In places rounded pieces of gravel and cobblestones occur in sufficient quantity to make the areas unfit or undesirable even for bathing beaches.

Included with coastal beach are a few areas of level sandy material that are not subject to wave action. These areas occur between the beaches and the dunes or back of the dunes and would have been classified as beach sand if they were extensive enough. There the vegetation consists of a scant cover of coarse grasses, but the land is of no importance for agricultural purposes. The best use of such areas is for building sites.

Dune sand.—Dune sand includes the reworked sand along the Atlantic coast that has been shaped by wind into ridges and dunes. These areas are bare or support only a sparse cover of coarse grasses. The sand consists mostly of rounded white quartz grains. It is of recent deposition and is still subject to frequent change during high winds or severe storms accompanied by strong winds and high water.

Dune sand occurs in narrow strips scattered along the Atlantic Ocean in both counties. Generally it is associated with coastal beach. This land is of value only as building sites for summer cottages. During the hurricane of September 21, 1938, however, practically every cottage on this type of land in Rhode Island was destroyed by the strong wind and the tidal wave.

Made land.—Made land represents areas that have been changed by man from their original form. It includes excavations, dumps, filled-in areas, and areas that have been artificially leveled. These areas are of no agricultural value. The largest area occurs in the town of Barrington near a brickkiln. It consists of a series of narrow ridges and excavations or pits and dumps.

Unclassified city land.—Most of the soils in the city of Newport have been so thoroughly turned over or filled in during building operations that it was not practicable to classify them and show them on the published map. Such areas are referred to as unclassified city land.

PRODUCTIVITY RATINGS

In table 7 the soils of Newport and Bristol Counties are listed alphabetically and estimated average acre yields of the principal crops are given for each soil.

The estimates in table 7 are based primarily on interviews with farmers, the county agricultural agent, members of the State experiment station and the college of agriculture staffs and others who have had experience in the agriculture of these counties. As such, they are presented only as estimates of the average production over a period of years according to prevailing types of management. It is realized that these estimates may not apply directly to specific tracts of land for any particular year, inasmuch as the soils as shown on the map vary somewhat, management practices differ, and climatic conditions fluctuate from year to year. On the other hand, these estimates appear to be as accurate information as can be obtained without further detailed and lengthy investigations, and they serve to bring out the relative productivity of the soils shown on the map.

In order to compare directly the yields obtained in Newport and Bristol Counties with those obtained in other parts of the country, yield figures have been converted in table 8 to indexes based on standard yields. The soils are listed in the approximate order of their general productivity under prevailing farming practices, the most productive at the head of the table.

TABLE 7.—*Estimated average yields per acre of the principal crops in each soil in Newport and Bristol Counties, R. I., under prevailing farming practices*[1]

Soil (soil types, phases, and land types)	Corn (grain)	Corn (silage)	Mixed hay	Clover	Alfalfa	Potatoes	Sweet corn	Tomatoes	Cabbage	String beans	Carrots	Beets	Lettuce	Spinach
	Bu.	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Doz. ears*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Crates*[2]	*Bu.*
Alluvial soils, undifferentiated														
Bernardston loam	45	12	2.00	2.00	3.25	275	900	350	350	275	450	350	500	600
Bernardston loam, level phase	45	13	2.25	2.25	3.50	300	900	350	350	300	450	350	500	600
Bernardston stony loam			1.00											
Coastal beach														
Compton loam	35	10	1.50	1.50	2.50	175	800	300	350	275	325	375	400	550
Compton loam, imperfectly drained phase	30	9	1.50				650		350					
Compton loam, level phase	40	11	1.75	1.75	2.75	200	800	350	350	275	325	300	400	550
Dune sand														
Gloucester fine sandy loam	20	8	1.00	1.00		150	650	275	250	225	325	275		450
Gloucester stony fine sandy loam														
Gloucester stony fine sandy loam, steep phase														
Made land														
Mansfield loam			1.00											
Mansfield silt loam			1.00											
Mansfield silty clay loam														
Mansfield stony loam														
Mansfield stony silty clay loam														
Merrimac loamy sand	10	3	.50				300	150	75	125				
Merrimac sandy loam	20	6	.75		1.50	125	550	250	150	175	275	250		350
Merrimac fine sandy loam	30	8	1.00	1.25	3.00	200	700	325	275	225	350	325	400	500
Muck and peat														
Muck and peat, shallow phase														
Narragansett fine sandy loam	30	9	1.25	1.25	2.50	200	700	300	275	225	350	300	400	500
Narragansett fine sandy loam, level phase	35	10	1.25	1.25	2.50	200	750	300	300	250	375	350	450	500
Narragansett stony fine sandy loam														
Newport loamy sand	10	3	.50				300	150	75	125				
Newport loamy fine sand	15	4	.50			75	350	150	100	125				
Newport loamy fine sand, level phase	15	4	.50			75	350	150	100	125				
Newport fine sandy loam	30	9	1.25	1.25	2.50	200	700	325	275	225	350	300	400	500
Newport fine sandy loam, level phase	35	10	1.50	1.50	3.00	250	800	350	325	275	450	325	450	550
Newport loam	45	12	2.00	2.00	3.25	275	900	350	350	275	450	350	500	600
Newport loam, imperfectly drained phase	30	9	1.50				650		350					
Newport loam, level phase	45	13	2.25	2.25	3.50	300	900	350	350	300	450	350	500	600
Newport loam, slope phase	30	7	1.00											
Newport loam, steep phase														
Newport stony fine sandy loam														
Newport stony loam, steep phase														
Peat, salt-marsh phase														
Quonset gravelly fine sandy loam														
Rough stony land														
Scarboro fine sandy loam														
Scarboro loam														
Tidal marsh														
Tiverton gravelly fine sand loam	25	9	1.25	1.25	2.25	175	700	300	275	225	350	275	375	500
Tiverton gravelly fine sandy loam, level phase	30	9	1.25	1.25	2.50	175	700	325	275	225	325	275	375	500
Tiverton gravelly loam	40	12	2.00	2.00	3.00	275	900	350	350	275	450	350	500	600
Tiverton stony gravelly fine sandy loam														
Tiverton stony gravelly fine sandy loam, level phase														
Tiverton stony fine sandy loam, steep phase														
Unclassified city land														
Warwick sandy loam	20	6	.75		1.50	125	550	250	150	175	275	250		350
Warwick gravelly fine sandy loam	20	6	.75			75	500	250	150	175	275	225		350
Warwick fine sandy loam	30	8	1.00	1.25	3.00	200	700	325	275	225	350	325	400	500
Warwick very fine sandy loam	40	11	1.75	1.75	3.50	325	1,000	400	325	300	500	400	500	600
Whitman silty clay loam														
Whitman stony loam														

[1] Prevailing practices include the use of commercial fertilizers, manure, and lime on most of the soils used for crops. Special treatments generally given the land for certain crops are as follows: Corn for silage, heavy applications of manure plus 300 to 400 pounds of complete fertilizer, such as 5-8-7, 4-12-4, or 4-8-4; market-garden crops, manure plus 1,000 to 2,000 pounds of complete fertilizer (5-8-7), with 1 to 2 tons of lime about every 3 to 5 years and rye and buckwheat turned under as green-manure crops; potatoes, 1 ton of complete fertilizer (commonly 5-8-7 or 5-10-10); hay, 1 to 2 tons of lime, 300 to 400 pounds of complete fertilizer in places, and seaweed in places as a top dressing.

[2] 18 heads to each crate.

TABLE 8.—*Productivity ratings for the soils of Newport and Bristol Counties, R. I., under prevailing farming practices* [1]

[A blank space indicates that a crop is not generally grown]

Soil (soil types, phases, complexes, and land types) [2]	Crop productivity index [3] for—															General productivity		Principal type of farming, crops, or use
	Corn as grain (100=50 bu.)	Corn as silage (100=2 tons)	Mixed hay [4] (100=2 tons)	Clover [5] (100=2 tons)	Alfalfa (100=4 tons)	Potatoes (100=200 bu.)	Sweet corn [6] (100=1,000 doz. ears)	Tomatoes [6] (100=400 bu.)	Cabbage [6] (100=350 bu.)	String beans [6] (100=300 bu.)	Carrots [6] (100=500 bu.)	Beets [6] (100=400 bu.)	Lettuce [6] (100=500 crates)	Spinach [6] (100=600 bu.)	Pasture [7] (100=100 cow-acre-days)	Grade [8]	Group [9]	
Newport loam, level phase	90	108	112	112	87	150	90	87	100	100	90	87	100	100	80	1	Very high	General farming: Hay, corn, vegetables, and potatoes.
Bernardston loam, level phase	90	108	112	112	87	150	90	87	100	100	90	87	100	100	80			
Warwick very fine sandy loam	80	90	87	87	87	160	100	100	90	100	100	100	100	100	70			
Newport loam	90	100	100	100	80	135	90	87	100	90	90	87	100	100	80			
Bernardston loam	90	100	100	100	80	135	90	87	100	90	90	87	100	100	80			
Tiverton gravelly loam	80	100	100	100	75	135	90	87	100	90	90	87	100	100	80	2	High	Corn, hay, vegetables.
Newport fine sandy loam, level phase.	70	83	75	75	75	125	80	87	90	90	90	80	90	90	65	3		General farming: Hay, corn, vegetables, and potatoes.
Compton loam, level phase	80	90	87	87	70	100	80	87	100	90	85	75	80	90	75			
Narragansett fine sandy loam, level phase.	70	83	62	62	62	100	75	75	85	83	75	87	90	83	60			
Compton loam	70	83	75	75	62	87	80	75	100	90	65	95	80	90	70			
Warwick fine sandy loam	60	65	50	62	75	100	70	80	80	75	70	80	80	83	50	4	Medium	Vegetables, hay, corn, potatoes.
Merrimac fine sandy loam	60	65	50	62	75	100	70	80	80	75	70	80	80	83	50			Do.
Tiverton gravelly fine sandy loam, level phase.	60	75	62	62	62	87	70	80	80	75	65	68	75	83	60			Do.
Newport fine sandy loam	60	75	62	62	62	100	70	80	80	75	70	75	80	83	60			Hay, corn, vegetables, pasture.
Narragansett fine sandy loam	60	75	62	62	62	87	70	75	80	75	70	75	80	83	60			Do.
Tiverton gravelly fine sandy loam.	50	75	62	62	55	87	70	75	80	75	70	68	75	83	50			Vegetables, corn, hay.
Gloucester fine sandy loam	40	65	50	50	.....	75	65	68	73	75	65	68	.....	75	50	5		Hay, corn, vegetables.
Newport loam, imperfectly drained phase.	60	75	75	.....	.....	.....	65	.....	100	.....	.....	.....	.....	.....	70			Pasture, hay, corn.
Compton loam, imperfectly drained phase.	60	75	75	.....	.....	.....	65	.....	100	.....	.....	.....	.....	.....	70			Do.

See footnote at end of table.

TABLE 8.—*Productivity ratings for the soils of Newport and Bristol Counties, R. I., under prevailing farming practices*—Continued

[A blank space indicates that a crop is not generally grown]

Soil (soil types, phases, complexes, and land types)	Crop productivity index for—															General productivity		Principal type of farming, crops, or use
	Corn as grain (100=50 bu.)	Corn as silage (100=2 tons)	Mixed hay[4] (100=2 tons)	Clover (100=2 tons)	Alfalfa (100=4 tons)	Potatoes (100=200 bu.)	Sweet corn (100=1,000 doz. ears)	Tomatoes (100=400 bu.)	Cabbage (100=250 bu.)	String beans (100=800 bu.)	Carrots (100=500 bu.)	Beets (100=400 bu.)	Lettuce (100=500 crates)	Spinach (100=600 bu.)	Pasture (100=100 cow-acre-days)	Grade	Group	
Warwick sandy loam	40	50	37		37	62	55	62	43	58	55	62		58	30	6	Medium to low.	Vegetables, fruits, pasture, forest.
Merrimac sandy loam	40	50	37		37	62	55	62	43	58	55	62		58	30			Do.
Warwick gravelly fine sandy loam.	40	50	37			37	50	62	43	58	55	55		58	30			Do.
Newport loam, slope phase	60	58	50												45	7		Pasture, hay.
Newport loamy fine sand, level phase.	30	33	25			37	35	37	30	40					25			Hay, vegetables, sweet corn.
Newport loamy fine sand	30	33	25			37	35	37	30	40					20			Do.
Merrimac loamy sand	20	25	25				30	37	20	40					20	8	Low	Vegetables, sweet corn, pasture.
Newport loamy sand	20	25	25				30	37	20	40					20			Do.
Newport loam, steep phase			50												45	9		Pasture, hay.
Bernardston stony loam			50												40			Pasture, forest.
Mansfield loam			50												40			Pasture, small amount in forest.
Mansfield silt loam			50												40			Do.
Mansfield silty clay loam															40			Do.
Whitman silty clay loam															40			Forest, with a small amount of grazing.
Alluvial soils, undifferentiated															40			Do.
Tiverton stony gravelly fine sandy loam, level phase.															35			Forest, pasture.
Narragansett stony fine sandy loam.															35			Do.

Quonset gravelly fine sandy loam.																35	9	Low	Pasture, hay.
Newport stony fine sandy loam.																35			Pasture, idle.
Scarboro loam																35			Forest, with a small amount of grazing.
Scarboro fine sandy loam																35			Do.
Tiverton stony gravelly fine sandy loam.																30			Forest pasture.
Newport stony loam, steep phase.																30			Pasture, forest.
Gloucester stony fine sandy loam.																25			Forest.
Mansfield stony loam																25			Forest, with a small amount of grazing.
Mansfield stony silty clay loam.																25			Do.
Whitman stony loam																25			Do.
Gloucester stony fine sandy loam, steep phase.																20			Do.
Muck and peat, shallow phase																10	10	Very low	Do.
Tiverton stony fine sandy loam, steep phase.																10			Do.
Rough stony land																10			Do.
Muck and peat																			Do.
Peat, salt-marsh phase																			Nonagricultural.
Tidal marsh																			Do.
Made land																			Do.
Unclassified city land																			Do.
Dune sand																			Do.
Coastal beach																			Do.

[1] See footnote 1, table 7.

[2] The soils are listed in the approximate order of their general productivity under prevailing farming practices.

[3] The soils are given indexes that indicate the approximate average production of each crop in percent of the standard of reference. The standard represents the approximate average yield obtained without the use of amendments on the more extensive and better soil types of those regions of the United States in which the crop is most widely grown. The indexes are based upon estimates of yields (see table 7), as specific yield data are very limited.

[4] Mixed hay includes timothy with varying proportions of red clover, alsike clover, redtop, orchard grass or Colonial (Rhode Island) bentgrass.

[5] Clover includes red clover alone or mixed with alsike or white (Dutch) clover.

[6] The standards used here for these crops have been selected only on the basis of yields in Rhode Island. They are not to be accepted as standards for all sections of the country.

[7] The indexes for pasture are less satisfactory than for the other crops, as specific data are difficult to procure. Cow-acre-days are a measure of the number of days during the year that 1 acre can support 1 animal unit without damage to the turf.

[8] The numbers indicate the general productivity of the soils for the common crops under prevailing farming practices. Refer to the text for further explanation.

[9] This is a generalized statement of relative productivity.

The rating compares the productivity of each of the soils for each crop to a standard—100. This standard index represents the approximate average yield per acre obtained without the use of amendments on the more extensive and better soil types of the regions of the United States in which the crop is most widely grown. An index of 50 indicates that the soil is about half as productive for the specified crop as is the soil with the standard index. The standard yield for each crop shown in table 8 is given at the head of each respective column. It is to be noted that the standards given here for sweet corn, tomatoes, cabbage, string beans, carrots, beets, lettuce, and spinach have been used so far only in Rhode Island. It is not expected that they can be used satisfactorily in other regions, such as the Winter Garden area of Texas. Soils given amendments, such as lime and commercial fertilizers, or special practices, such as irrigation, and unusually productive soils of small extent may have productivity indexes of more than 100 for some crops.

The principal factors affecting the productivity of land are climate, soil (this includes the many physical, chemical, and biological characteristics), slope, drainage, and management, including the use of amendments. No one of these factors operates separately from the others, although one may dominate. In fact, the factors listed may be grouped simply as the soil factor and the management factor, as slope, drainage, and most of the aspects of climate may be considered as characteristics of a given soil type. The soil type, as such, occupies specific geographical areas characterized by a given range of slope and climatic conditions. Crop yields over a long period of years furnish the best available summation of the associated factors, and, therefore, are used where available.

The soils are listed in table 8 in the order of their general productivity according to the prevailing practices. General productivity grade numbers are assigned in the column "General productivity grade." The general productivity grade is based on a weighted average of the indexes for the various crops, the weighting depending upon the relative acreage and value of the crops. If the weighted average is between 90 and 100, the soil type is given a grade of 1; if it is between 80 and 90, a grade of 2 is given, and so on.[10] Because it is difficult to measure mathematically either the exact significance of a crop in the agriculture of an area or the importance or suitability of certain soils for particular crops, perhaps too much significance may be given to the order in which the soils are listed. On the other hand, the arrangement will give information as to general productivity. "General productivity group" is a broad grouping to bring out in general terms the relative productivity of the soils of Newport and Bristol Counties.

Productivity tables do not present the relative roles that soil types, because of their extent and the pattern of their distribution, play in the agriculture of the county. The tables show the relative productivity of individual soils. They cannot picture in a given county the total quantitative production of crops by soil areas without the additional

[10] *Instead of following the usual procedure for weighting by percentages the indexes of the individual crops, the general productivity grade numbers in table 8 have been assigned from visual inspection of the indexes, and no mathematical calculations have been used. The placing of the soils results, therefore, from an approximation of the average of the indexes.*

knowledge of the acreage of the individual soil types devoted to each of the specified crops.

Economic considerations have played no part in determining the crop productivity indexes. They cannot be interpreted, therefore, into land values except in a very general way. Distance to market, relative prices of farm products, and other factors influence the value of land. It is important to realize that productivity, as measured by yields, is not the only consideration that determines the relative worth of a soil for growing crops. The ease or difficulty of tillage and the ease or difficulty with which productivity is maintained, are examples of other considerations than productivity that influence the general desirability of a soil for agricultural use. In turn, steepness of slope, presence or absence of stone, the resistance to tillage offered by the soil because of its consistence or structure, and the size and shape of areas are characteristics of soils that influence the relative ease with which they can be tilled. Likewise, inherent fertility and susceptibility to erosion are characteristics that influence the ease of maintaining soil productivity at a given level. Productivity, as measured by yields, is influenced to some degree by all of these and other factors, such as moisture-holding capacity of the soil and its permeability to roots and water, and so they are not factors to be considered separately from productivity, but, on the other hand, schemes of land classification to designate the relative suitability of land for agricultural use must give some separate recognition to them.

The right-hand column of table 8 gives information regarding the principal crops grown on or the use made of each soil.

LAND USES AND AGRICULTURAL METHODS

Most of the well-drained soils of Newport and Bristol Counties have favorable texture and structure for deep root penetration, adequate drainage, and good moisture-holding capacity. The soils in this area are not inherently so fertile as soils of some other parts of the United States, such as the soils of the Great Plains of the Middle West. They respond to fertilization and care, however, and are adapted to a great variety of crops in places where the stones and trees have been cleared off and the relief is favorable for farming operations. With the exception of some of the light sandy soils on the outwash plains, all the cultivated soils of the two counties are capable of being built up to and maintained in a fairly productive state. No particular soil is especially adapted to any certain crop or crops. The heavier textured till soils, however, are the most productive for such crops as grasses, corn, small grains, and certain market-garden crops. The lighter textured soils are not quite so productive for grasses, corn, and small grains but are well suited to market-garden crops, potatoes, and small fruits with liberal fertilization and care.

In general the cultivated soils of the area are used to good advantage, and an effort is made by most farmers to build up their soils by adding barnyard manure, commercial fertilizer, lime, and seaweed and by turning under green-manure crops. On some of the soils, the yields of market-garden crops could be greatly increased with irrigation, but the cost of irrigation is too high to justify this at present.

As dairying is an important enterprise in the area, it would seem that some of the poorly drained soils could be used to better advan-

tage for grazing. When cleared of trees, brush, and weeds, these soils furnish fair to good grazing during the late spring, summer, and early fall. A little fertilization in places would give good results on these poorly drained areas.

Some of the idle land on Block Island and Conanicut Island could be used for producing vegetables to supply the summer population, as the vegetables, poultry, eggs, and milk produced on these islands are not sufficient to supply the summer trade. Of course farmers on these islands are at a disadvantage in any competition in the markets on the mainland because of distance and cost of transportation.

Commercial fertilizers and lime are used extensively, especially on the market-garden farms. Unmixed chemicals are used on a few farms. There is a general tendency to use a higher phosphorus fertilizer for corn or to supplement the regular fertilizer with superphosphate. For potatoes there is a general tendency to use a commercial fertilizer with a higher percentage of potash than has been used heretofore.

Table 9 gives recommendations for the use of fertilizers for the principal farm crops of Rhode Island.

TABLE 9.—*Recommendations for the use of fertilizers for the principal farm crops of Rhode Island* [1]

Recommendations for—	Fertilizer	Acre application
		Pounds
New seedings of alfalfa, clover, and clover mixtures	4–16–20	400–500
Do	2–8–10	800–1,000
Do	Nitrogen fertilizer [2]	100–125
	16-percent superphosphate	400–500
	50-percent muriate of potash	160–200
Top-dressing alfalfa, clover, and mixtures of either or both	4–16–20	400–500
Do	2–8–10	500–1,000
Do	Nitrogen fertilizer [2]	100–125
	16-percent superphosphate	400–500
	50-percent muriate of potash	160–200
Top-dressing grass hay and pastures	8–16–16	300–500
Do	5–8–7	500–800
Do	10–16–14	300–500
Do	Nitrogen fertilizer [2]	150–250
	16-percent superphosphate	300–500
	50-percent muriate of potash	100–160
Corn and small grains	8–24–8	300–500
Do	4–12–4	600–800
Do	5–10–5	400–500
Do	Nitrogen fertilizer [2]	150–250
	16-percent superphosphate	450–800
	50-percent muriate of potash	50–100
Fall-sown small grains	8–24–8	200–300
Do	4–12–4	400–600
Do	5–10–5	300–400
Do	Nitrogen fertilizer [2]	150–250
	16-percent superphosphate	450–800
	50-percent muriate of potash	50–100
Potatoes	8–16–16	1,000
Do	4–8–8 or 5–10–10	1,000
Do	4–8–10	2,000
Do	8–16–20	1,000
Vegetables and market-garden crops	5–8–7	1,500–2,000
Do	5–10–5	1,500–2,000
Do	5–10–10	1,500–2,000

[1] Prepared by the Rhode Island Agricultural Experiment Station and the Extension Service of the Rhode Island State College.

[2] Nitrogen fertilizers: Nitrate of soda, cyanamid, and Cal-Nitro. (When cyanamid or Cal-Nitro is used, the given quantities may be reduced one-fifth.)

On light soils additional side dressings of soluble nitrogen materials probably will be necessary for vegetable crops, especially in years of heavy rainfall.

The fertilizer recommendations for meadow top dressing, corn, and small grains, would be reduced one-fourth to one-half when manure is used, depending on the amount applied and the quality of the manure. Unless superphosphate is used in the gutters of the stable (1 to 2 pounds per cow per day) 50 pounds per ton of manure should be used when the manure is spread.

Soils of light texture, such as Merrimac and Warwick fine sandy loam, Merrimac and Warwick sandy loams, and Gloucester fine sandy loam, all which are less productive than the better loam soils, such as Newport loam and Tiverton gravelly loam, should receive heavier application of all the fertilizers listed.

All the soils of these two counties are acid, ranging from extremely acid to medium acid. Most farmers recognize the need of lime as an economical method of improving the land and increasing crops yields in general. T. E. Odland, head of Department of Plant Industry, Rhode Island State College, gives the following recommendations for the use of lime for various crops on the soils of Rhode Island.

The amount of lime needed for any farm or soil type will depend largely on the present condition of the soil and on what crops are to be grown. Light soils can be corrected for acidity with relatively less amounts of lime than can the heavier soil types. However, after being brought to the right degree of acidity, the heavier soils maintain this condition longer than the lighter ones.

For potatoes a pH of about 5.2 to 5.4 seems to be near optimum considering yield and freedom from scab. In less acid soil than this scab is likely to become serious, whereas more acid soils do not yield so well.

Clover for optimum results needs a soil limed to a pH of 6 or better, and alfalfa does best where the soil acidity is not greater than 6.5. Again, the method of cropping and amount of manure and fertilizer used have considerable influence. Where stable manure is used liberally, both clover and alfalfa can stand greater soil acidity than where little or none is used.

For nearly all market-garden crops the soils need to be limed to a near neutral point for best results.

Very few farmers practice definite crop-rotation systems over a period of years, but most farmers recognize that rotation is an essential part of good farming, and some form of rotation is practiced on the better farms. The most common rotations followed, but not strictly adhered to, are as follows: (1) Corn 1 or 2 years, followed by hay and pasture to 8 years; and (2) corn 1 year, potatoes or some other cash crop 1 year, followed by hay from 3 to 6 years. On the strictly market-garden farms, crops are changed around so that the same one is not grown on the same field too often. A cover crop of rye generally is sown in the fall on the better farms.

The following crop rotations are suggested by the Rhode Island Agricultural Experiment Station:

For dairy farms—(1) silage corn 1 or 2 years; potatoes; hay 2, 3, or 4 years; and pasture 1 to 3 years; and (2) silage corn; hay 2 to 4 years; and pasture 1 to 3 years. The number of years in hay, whether to use tillable land for pasture, and whether to include additional crops in the rotation will depend on individual conditions.

For potato farms—(1) potatoes; clover and grass; (2) potatoes 2 or 3 years; clover and grass; and (3) potatoes 2 to 5 years; green manures 1 year. The green manures are rye followed by buckwheat, soybeans, or millet, then rye again in the fall. Fall rye should be sown following potatoes every year as a cover crop unless a meadow mixture has been seeded.

Rotations for vegetable growers are difficult to prescribe. Crops should be changed around so that the same one is not grown on the same land too often. Provision should be made to grow as many green-manure and cover crops of rye, buckwheat, millet, and soybeans as possible in the cropping system.

Rotations for poultry raisers are also difficult to suggest, as most poultry producers carry on this enterprise on comparatively small areas of land and the growing of feed is of minor importance.

Seeding mixtures for hay lands and pastures vary somewhat, depending on the texture, drainage, and acidity of the soil to be seeded. Information on the best seeding mixture for a given soil type may be obtained from the Rhode Island Agricultural Experiment Station or from the county agent.

The crop varieties commonly grown in Newport and Bristol Counties are those generally recommended by the Rhode Island Agricultural Experiment Station and the Rhode Island Farm Bureau. Varieties of field crops, market-garden crops or vegetables, and fruits most commonly grown are as follows:

Field crops:

Corn (for grain)—Rhode Island White Flint; corn (for silage)—West Branch Sweepstakes, Improved Learning, and Eureka; potatoes—Green Mountain (late), Irish Cobbler (early), and Chippewa (intermediate); alfalfa—Grimm or Canadian Variegated; clover—northern-grown seed; rye—Rosen or similar winter varieties; soybeans—Manchu (for hay or silage).

Market-garden crops:

Sweet corn—Yellow Bantam, Golden Sunshine, and Golden Cross Bantam; tomatoes—Bonny Best, Pritchard, and Marglobe; cabbage—Copenhagen (early), Wakefield (early), Savoy (late), and Danish Ballhead (late); carrots—Hutchinson, Tendersweet, Red Core Chantenay, and Danvers; beans—Bountiful, Burpee Stringless Green Pod, Valentine, Tendergreen, Surecrop, and Kentucky Wonder; beets—Crosby Egyptian and Detroit Dark Red; peppers—World Beater, Italian Sweet, and Early Giant; spinach—Long Standing Bloomsdale and Virginia Savoy; squash—Straightneck and Blue Hubbard No. 1.

Fruits:

Apples—McIntosh, Baldwin, Gravenstein, and Rhode Island Greening; peaches—Elberta and Champion; pears—Bartlett; strawberries—Howard 17, Dorsett, and Fairfax; raspberries—Latham, Newburgh, and Taylor; blueberries—Pioneer; grapes—Concord.

Soil erosion is not a serious problem on the soils in this area. Only a small percentage of the total acreage is in clean-cultivated crops, and on much of this land the degree of slope is such that erosion is not serious under continuous clean cultivation where proper cultural methods are practiced. The susceptibility of land to erosion is closely associated with degree of slope, cultural methods, and the kind of crops grown. Practically all of the cultivated land in the area ranges in relief from nearly level to sloping. In other words the slopes have a gradient of not more than 10 percent. Most of the land with a slope of more than 10 percent is in grasses for hay and pasture, in forests, or lying idle with a cover of native grasses, weeds, and brush.

Much of the cultivated land with a slope of any consequence is cultivated more or less across and not up and down the slope. This method of cultivation should be applied to all the cultivated land with a slope of over 3 percent. Most farmers realize the need of proper tillage and land use to protect their soils from erosion.

Probably over 60 percent of the cultivated land occurs in smooth areas with a maximum slope of 5 percent. On this land erosion is of no consequence if proper tillage and land use are practiced. On the land with slopes ranging from 5 to 10 percent more care must be taken to control the surface water after heavy rains. Much of this land fits in with the common rotation on the dairy farms, however, and is in grass for hay and pasture most of the time. The areas used for clean-cultivated crops should be cultivated along the contour as nearly as practicable and rotated as often as possible with grasses and other close-growing crops. In some instances strip cropping on the more sloping areas might be advisable.

Little attention is given to the forest land, as regards fire prevention and the control of diseases and insects. The hurricane of September 21, 1938, worked havoc with the forests, uprooting or breaking off many of the trees. This also greatly increased the fire hazard.

Much information on crops, fertilizers, crop rotations, and crop varieties can be obtained from bulletins published by the Rhode Island Agricultural Experiment Station. These bulletins are mailed free on request.

MORPHOLOGY AND GENESIS OF SOILS

Newport and Bristol Counties lie within the Brown Podzolic soils region.[11] The physiography of the area is characterized by fairly smooth rounded hills with gentle slopes and nearly level to gently undulating glacial plains. The elevation ranges from sea level to a maximum of 340 feet above, but in only one place does the elevation rise above 300 feet. The average annual rainfall is about 40 inches. Drainage ranges from good to poor. The Brown Podzolic soils region occurs in the northeastern United States south and east of the true Podzol area of New England. Essentially, the Brown Podzolic soils are imperfectly developed podzols. A normal mature profile in this region, under forest cover, has an organic mat on the surface from ½ to 2 inches thick, and a very thin leached layer just beneath it. This leached layer varies from a mere film to about one-half inch in thickness. In places it is not noticeable; elsewhere it is well developed particularly in the light-textured soils. The B horizon may be yellow, yellowish-brown, or brown, and it becomes lighter in color and texture with depth. In places there are the beginnings of a dark-brown orterde just beneath the leached layer or the surface mat. The depth of the solum ranges from 24 to 30 inches in most places. Practically all of the soils developed from shales, slates, conglomerates, and sandstone have been disturbed, and it is hard to tell just how much podzolization has taken place. These soils are not so susceptible to podzolization as are those developed from granitic materials, however, because of the lower content of siliceous materials. There is some question as to whether

[11] Most of the well-drained, well-developed soils of southern New England differ in several respects from the Gray-Brown Podzolic soils of the Middle-Atlantic and North-Central States, with which they were formerly included in the classification. The 1938 Yearbook of Agriculture, Soils and Men, recognized this difference by making a new group—the Brown Podzolic soils. As a consequence, most of the soils of Kent and Washington Counties called Gray-Brown Podzolic soils in the soil survey report of that area in reality belong to the newly named Brown Podzolic group.

these soils belong with the Brown Podzolic soils or the Gray-Brown Podzolic soils.

The soils have developed under a forest cover of mixed hardwoods and conifers. All the original forest cover has been cut, and the present forest consists of second- and third-growth trees of the species named. The distribution of the trees is correlated with drainage, texture, and depth of the soil. Both the climate and the soils over most of the area favor rapid growth of vegetation, and raw humus has accumulated on the surface of virgin land or even on land once cultivated but now abandoned and reverting to forest. The amount of organic matter accumulated on the surface is correlated, in a general way, with the degree of drainage. On the poorly drained or imperfectly drained soils conditions are most favorable for a rapid growth of dense vegetation, and in such places the most organic matter has accumulated. On the light sandy soils, which are inextensive, the accumulation of organic matter is small because of the low fertility, droughtiness, and the consequent sparse or stunted vegetation.

The climatic conditions are such that the ground is frozen or covered with snow several months during the year, thereby preventing leaching, but having sufficient rainfall during the rest of the year to cause some leaching. The summers are sufficiently warm to allow some disintegration of the organic matter on the surface. Disintegration and leaching of the organic matter are more rapid on the light sandy soils than on the heavier textured soils. Most of the cultivated soils are deficient in organic matter and could be improved both physically and chemically by the addition of organic matter in the form of barnyard manure, seaweed, and green-manure crops.

Newport and Bristol Counties lie within the glaciated region of North America, where the materials from which the soils have developed have accumulated largely through glacial action and have been deposited as till by the receding glacier or as outwash material from the melting glacier. The glacial covering from which the till soils have developed ranges in depth from very shallow to 10 feet or more. In small local areas bedrock lies at a slight depth or outcrops on the surface, on which little or no glacial debris was deposited. In such places the soils have developed partly from residual materials. The outwash materials from which the soils on the glacial plains have developed consist of rather coarse assorted materials. At the time of deposition, the till was little altered mineralogically, whereas, the outwash material was altered considerably by the loss of fine materials and minerals. Soils developed from recent alluvial materials are of very small extent in this area.

As much of the glacial material has been transported only a short distance, the underlying rock formations play an important part in the distribution of the parent material from which the soils have developed. The Gloucester and Narragansett soils have developed largely from granitic materials, and the underlying bedrock consists of granite, granitic gneiss, and a small quantity of other rocks in places. The Newport, Bernardston, and Compton soils have developed from till composed of shale, slate, conglomerate, sandstone, and schist, and the underlying rocks consist of the same materials. The soils developed chiefly from conglomerate and sandstone, with

a small quantity of granitic material, are classified as Tiverton soils. The Merrimac and Warwick soils have developed on glacial plains from reworked outwash material consisting mainly of granitic materials or materials consisting of slate, shale, and schists, respectively. The Quonset soils have developed on the kames from reworked outwash materials composed largely of shales, slates, and sandstone.

All the soils are acid in all layers. The soils developed from shales, slates, conglomerates, and sandstone are the least acid. Table 10 gives the pH values of several soils of Newport and Bristol Counties.

TABLE 10.—*pH determinations of samples of seven soils from Newport and Bristol Counties, R. I.*[1]

Soil type and sample No.	Depth	pH	Soil type and sample No.	Depth	pH
Narragansett fine sandy loam:	*Inches*		Newport loam:	*Inches*	
140501	0- 6	4.0	140518	0- 7	4.0
140502	6- 17	4.4	140519	7-19	4.7
140503	17- 21	4.5	140520	19-30	5.3
140504	21- 48	4.1	140521	30-60	6.0
140505	48+	5.1	Bernardston loam:		
Quonset gravelly fine sandy loam:			140522	2- 0	3.3
140506	0- 5	4.3	140523	0- 5	3.8
140507	5- 18	4.4	140524	5-10	4.1
140508	18-120	4.7	140525	10-21	4.3
Warwick very fine sandy loam:			140526	21-28	4.3
140509	0- 7	4.4	140527	28-40	4.6
140510	7- 11	4.6	140528	40-60+	4.5
140511	11- 29	4.6	Newport fine sandy loam:		
140512	29- 36	4.8	140529	0- 7	4.9
140513	36- 46+	5.3	140530	7-16	5.3
Compton loam:			140531	16-28	5.5
140514	0- 7	3.9	140532	28-34	5.6
140515	7- 15	4.3	140533	34-72	5.6
140516	15- 30	4.4			
140517	30- 72	4.9			

[1] Determinations made by E. H. Bailey in the laboratories of the Bureau of Plant Industry, U. S. Department of Agriculture.

The mechanical analysis of a sample of Gloucester sandy loam from Midway, Mass., indicates that there has been little transfer of material within the profile.[12] No significant variations in colloid content were observed. However, the chemical analysis of the same sample indicates that eluviation of iron and alumina has been marked. The silica-sesquioxide ratio of the B_2 horizon is 0.64, and the silica-alumina ratio 0.79. The Gloucester soils from Rhode Island and Massachusetts are very similar, and it is assumed that the analysis of a sample of Gloucester soil from Rhode Island would give the same results.

All the soils are comparatively young. The light-textured soils in general are derived from light-textured material. There is a close correlation between the texture of the parent material and the soil. In poorly drained areas little development of a profile has taken place; whereas in the well-drained uplands the soils have reached a fair stage of maturity.

Gloucester stony fine sandy loam is representative of the normal mature profile of the area. Following is a description of a profile of Gloucester stony fine sandy loam, as observed in a wooded area about 1½ miles south of Bliss Corners, Newport County.

[12] BROWN, IRVIN C., and BYERS, HORACE G. CHEMICAL AND PHYSICAL PROPERTIES OF CERTAIN SOILS DEVELOPED FROM GRANITIC MATERIALS IN NEW ENGLAND AND THE PIEDMONT, AND OF THEIR COLLOIDS. U. S. Dept. Agr. Tech Bul. 609, 65 pp. 1938.

1. A 1-inch layer of dark-brown organic material.
2. 0 to 1 inch, grayish-brown loose fluffy fine sandy loam containing a small quantity of organic matter.
3. 1 to 1½ inches, light-gray highly leached acid fine sandy loam.
4. 1½ to 14 inches, yellow or brownish-yellow mellow friable fine sandy loam containing a small quantity of gritty material and small rock fragments. This layer has a very soft crumb structure and contains some roots and worm casts. The upper part is more brown than the lower part.
5. 14 to 24 inches, grayish-yellow loose friable light fine sandy loam containing more gritty material and rock fragments than the layer above. This layer becomes lighter in color and texture with depth.
6. 24 to 48 inches +, light-gray or yellowish-gray loose gritty and gravelly till with very little or no compaction. This till is composed of granitic material, becomes coarser with depth, and contains many boulders and rock fragments. The depth to bedrock varies. It is more than 10 feet in places.

Many granitic boulders are scattered over the surface and throughout the soil mass.

Gloucester fine sandy loam differs from Gloucester stony fine sandy loam only in stone content.

The Narragansett soils also have developed from granitic till and have profiles somewhat similar to those of the Gloucester soils. They differ from the Gloucester soils in having more of the finer materials throughout, in being slightly darker, and in having a compact C horizon. The content of organic matter is slightly higher in the surface layer, owing to less perfect drainage. The upper part of the B horizon is paler yellow or more yellowish brown than the corresponding horizon in the Gloucester soils, and the lower part is darker grayish yellow. The greatest difference between the soils of these two series is in the C horizon. The C horizon of the Narragansett soils, beginning at a depth ranging from 24 to 30 inches, consists of gray or dark-gray fairly compact till that is easily broken down when crushed between the fingers. In places this compact layer is only from 1 to 2 feet thick over loose till; whereas, in other places it continues to a depth of many feet. In all places it is sufficiently compact to restrict percolating water. Locally, it is called a hardpan; but it is not impervious to water and lacks the hardness and chemical characteristics of a true hardpan. Just above this compact till there are, in most places, gray, yellow, and rust-brown mottlings, which are not characteristic of the Gloucester soils.

Associated with the Gloucester and Narragansett soils are small areas of poorly drained Whitman soils, which occur in small depressions along streams and around springs. Because of poor drainage these soils have not been acted on by the soil-forming processes to an appreciable extent, and they are considered young or immature. The Whitman soils have dark-brown or nearly black surface soils over mottled subsoils; in most areas they are stony and are covered with water part of the time.

The Tiverton soils have developed from conglomerate, sandstone, and a smaller quantity of granitic material; and the surface soils are gravelly. The characteristics of the profile are somewhat similar to those of the Narragansett soils, but as these soils are influenced more by darker materials they are slightly darker throughout and have a somewhat green cast in places. The till from which these soils have developed is fairly dark gray or bluish gray. It is fairly compact but breaks down easily when crushed. These soils may be

considered intermediate in character and composition of the parent material and in the color of the different horizons between the Gloucester and Narragansett soils on the one hand and the Newport and Bernardston soils on the other.

The Newport, Bernardston, and Compton soils have somewhat different characteristics from the soils previously described, due to the material from which they have developed. These soils have developed from glacial till composed largely of shale, slate, conglomerate, sandstone, and schist in varying proportions, and they occur for the most part in nearly level to sloping areas. These soils are not quite so acid as the soils developed from granitic material.

Following is a description of a profile of Newport loam as observed four-fifths of a mile southeast of Coggeshall Point, Newport County, in a pasture that has been in sod for several years.

1. 0 to 7 inches, brown or grayish-brown mellow friable loam that is well matted with small roots and contains some worm holes. When dry the material in this layer is grayish brown with a salty or olive tinge, and when moderately moist it is brown. This layer has a soft crumb structure when broken down, and the lower part has a weak platy structure in place. On a freshly cut surface or when the soil material is pressed between the fingers the brown color is intensified. A few angular and flat rock fragments of shale, sandstone, and schist are scattered over the surface and through the surface soil.
2. 7 to 19 inches, pale yellowish-brown or olive-brown friable open porous loam containing a few roots, some root holes, and some worm holes. When dry this layer is pale yellowish brown with an olive tinge, and when wet the color is olive brown or olive drab. When the soil material is pressed between the fingers or on a freshly cut surface the yellowish-brown color is intensified. This layer has a weak platy structure in place but breaks down to a soft crumb structure. Angular and flat shale and slate fragments are scattered throughout.
3. 19 to 30 inches, olive-gray friable open porous gravelly and gritty loam. When wet the color is dark olive gray, and when dry it is light olive gray with a somewhat brown cast. The brown color shows up more when the material is crushed between the fingers. This layer is firm in place, has a soft crumb structure when broken down, and contains only a few roots but many small worm holes.
4. 30 to 60 inches, bluish-black or bluish-gray fairly compact but friable gravelly and gritty till composed chiefly of shale, slate, and sandstone fragments and becoming coarser with depth. When moist this till has a greasy or slick appearance and feel when rubbed between the fingers.

The pH values of the surface layer and the till determined by field tests indicate that the soil is acid.

The Bernardston and Compton soils differ somewhat from the Newport soil. Compton loam has developed from material having a higher percentage of dark-colored slate and shale and is characterized by a darker surface soil and subsoil containing more gravel and rock fragments than the Newport soils. The Compton soils are not so well developed as the Newport soils; in some places there is little gradation between the surface soil and subsoil, and in other places the depth of the soil is only 12 to 18 inches.

Bernardston loam differs from the Newport soils in having a 2- to 8-inch yellowish-brown or light yellowish-brown layer just beneath the surface layer. This is probably due to slightly better drainage conditions or to the fact that the till from which this soil has developed contained a lower percentage of dark-colored shales and slates.

Following is a description of a profile of Bernardston loam, as observed in a wooded area 1⅗ miles northwest of Sandy Point, Newport County.

1. A loose and fluffy organic layer about 2 inches thick.
2. 0 to 5 inches, rich-brown mellow friable loam well matted with small roots and having a soft crumb structure.
3. 5 to 10 inches, yellowish-brown firm in place but mellow and friable loam containing a few roots and some root holes and worm holes. The top of the layer is slightly stained with organic matter. This layer also has a soft crumb structure.
4. 10 to 21 inches, grayish-brown, with an olive tinge, mellow and friable loam with very few roots but some root holes and worm holes. When the material is pressed between the fingers the color changes to yellowish brown.
5. 21 to 28 inches, light olive-gray, with a yellow tinge, friable loam. The yellow color becomes more noticeable when the material is crushed between the fingers or on a freshly cut surface.
6. 28 to 40 inches, mottled yellow, gray, and brown, firm in place but friable, coarse and gritty loam till.
7. 40 to 60 inches +, olive-gray or dark olive-gray fairly compact but friable very gravelly and gritty till composed largely of shale, sandstone, and schist fragments.

The surface soil and subsoil layers carry a small quantity of small angular and flat rock fragments consisting mainly of blue shale and sandstone.

The poorly drained soils associated with the Newport, Bernardston, and Tiverton soils belong to the Mansfield series. Like the Whitman soils these have dark-brown or black mucky surface soils over mottled subsoils and occur in depressions, along streams, or around seepage springs. The Mansfield soils are not so acid as the Whitman soils.

The soils developed on the outwash plains are variable in texture, but all the well-drained soils have fairly well developed profiles. The members of the Warwick series have developed from outwash material composed largely of shale, slates, schists, and sandstone. Following is a description of Warwick very fine sandy loam as observed in an idle field a quarter of a mile east of Sapowet Point, Newport County.

1. 0 to 7 inches, rich-brown mellow and friable very fine sandy loam well matted with grass roots and containing a small quantity of flat shale and slate fragments.
2. 7 to 11 inches, yellowish-brown mellow and friable very fine sandy loam or loam, which also is fairly well matted with grass roots and breaks down into a soft crumb structure. This layer contains many worm holes, some organic stains, and a small quantity of gravel.
3. 11 to 29 inches, yellowish-gray mellow and friable very fine sandy loam, which is lighter than the material in the layers above. It contains a small quantity of grass roots, worm holes, and gravel.
4. 29 to 36 inches, light olive-gray or gray, mottled with brown and yellow, very fine sandy loam that contains more gravel than the layers above.
5. 36 to 46 inches +, dark-gray loose incoherent stratified sand and gravel. The gravel is composed largely of flat and rounded shale, slate, sandstone, and schist, together with a small quantity of granitic material.

The lighter textured Warwick soils are somewhat similar to Warwick very fine sandy loam in profile characteristics. Drainage is better in the lighter textured soils, and no mottling occurs in the lower part of the B horizon. The depth to sand and gravel in these lighter soils ranges from 18 to 30 inches.

The Quonset soils have developed on the kames from the same material as the Warwick soils. These soils are shallow and gravelly.

The soils of the Merrimac series have developed from outwash material containing a high percentage of granitic material, and it is in this respect that they differ most from the Warwick soils. The profile characteristics of the two soils are very similar. The Warwick soils are slightly darker and probably a little less acid than the Merrimac soils.

The Scarboro soils occupy the poorly drained areas associated with the Warwick and Merrimac soils. These soils have dark-brown surface soils over a rust-brown organic layer, which is underlain by loose gray, yellow, or brown sand or sandy loam.

The organic soils vary in degree of decomposition and in thickness. They are classed as muck and peat; muck and peat, shallow phase; and peat, salt-marsh phase. Soils developed from recent alluvium are of very small extent. They are poorly drained, and little or no development of a profile has taken place.

Miscellaneous land types, such as rough stony land, dune sand, coastal beach, tidal marsh, made land, and unclassified city land have no true soil characteristics.

Table 11 gives the results of mechanical analyses of several soil profiles from Newport and Bristol Counties, R. I.

TABLE 11.—*Mechanical analyses of samples of 7 soils from Newport and Bristol Counties, R. I.*

Soil type and sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
Narragansett fine sandy loam:	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
140501	0–6	3.8	7.4	5.6	11.4	20.2	43.4	8.2
140502	6–17	6.0	9.7	7.0	11.6	14.8	44.1	6.8
140503	17–21	10.1	14.0	9.5	14.4	12.7	32.3	7.0
140504	21–48	11.4	16.7	11.2	16.2	9.6	24.2	10.7
140505	48+	8.0	13.3	10.3	17.0	10.8	28.2	12.4
Quonset gravelly fine sandy loam:								
140506	0–5	6.1	9.3	8.8	18.4	16.6	34.8	6.0
140507	5–18	6.3	11.3	8.8	17.9	17.2	34.2	4.3
140508	18–120+	30.9	46.4	9.6	3.3	1.2	5.9	2.7
Warwick very fine sandy loam:								
140509	0–7	1.6	3.6	3.6	7.0	18.2	58.2	7.8
140510	7–11	0.8	2.2	2.7	6.6	18.8	64.0	4.9
140511	11–29	0.5	1.2	1.9	5.2	21.7	65.7	3.8
140512	29–36	0.9	1.8	1.8	4.3	18.3	69.6	3.3
140513	36–46+	19.4	32.3	15.3	12.0	6.2	13.1	1.7
Compton loam:								
140514	0–7	5.8	5.9	4.9	11.1	10.8	49.6	11.9
140515	7–15	3.2	4.6	3.9	8.0	10.7	58.5	11.1
140516	15–30	4.4	6.7	5.1	10.5	11.7	52.4	9.2
140517	30–72	8.8	10.2	6.8	13.4	12.3	42.5	6.0
Newport loam:								
140518	0–7	3.7	7.6	6.9	11.4	14.2	46.6	9.6
140519	7–19	6.0	7.8	6.5	10.8	11.2	48.0	9.7
140520	19–30	9.0	11.1	8.9	14.1	11.8	38.5	6.6
140521	30–60	13.3	18.9	11.7	14.8	8.3	27.3	5.7
Bernardston loam:								
140523	0–5	2.1	2.9	3.5	9.4	14.9	56.7	10.5
140524	5–10	2.0	3.1	3.0	8.7	13.2	64.2	5.8
140525	10–21	3.9	4.5	4.2	10.3	14.0	55.3	7.8
140526	21–28	4.7	5.0	4.3	11.0	13.7	54.7	6.6
140527	28–40	5.5	5.0	4.5	10.5	14.1	53.8	6.6
140528	40–60+	7.9	9.5	5.5	11.0	10.4	50.8	4.9
Newport fine sandy loam:								
140529	0–7	1.2	2.5	11.0	54.4	5.7	19.2	6.0
140530	7–16	5.2	5.0	6.7	22.4	9.9	42.0	8.8
140531	16–28	3.8	6.2	6.7	19.2	11.0	45.1	8.0
140532	28–34	5.2	7.0	7.3	16.4	9.9	47.5	6.7
140533	34–72	7.9	11.6	11.4	19.3	10.5	34.4	4.9

SUMMARY

Newport and Bristol Counties, comprising a total area of 138 square miles, are in the southeastern part of Rhode Island. About one-half of the total area of Newport County is made up of islands. In general the relief is characterized by fairly smooth rounded hills, the slopes of which range from nearly level to sloping, and nearly level to gently undulating glacial plains. The elevation ranges from sea level to a maximum of about 340 feet.

The climate is humid. The winters are medium cold and the summers short and warm. The mean annual temperature is about 49° F., and the average annual precipitation is about 40 inches which is well distributed over the seasons.

Originally, both counties supported a dense forest growth consisting of mixed deciduous and coniferous trees with variations in dominant species corresponding to differences in soil texture and conditions of drainage. The present forest growth consists of second- or third-growth trees of the original species.

Agriculture was the chief pursuit of the early settlers, and it advanced rapidly until around 1880, when the development of manufacturing in New England became important and the more fertile and easily tilled lands of the west were opened up. In 1935 about 35 percent of the land area of Newport County and about 25 percent of the area of Bristol County was in improved land, which included cropland and plowable pasture. The present agriculture of the two counties consists principally of dairy farming, market gardening, poultry raising, and potato growing. Other enterprises of less importance are the growing of nursery stock, orcharding, the culture of small fruits and flowers, and cattle raising. Hay and forage crops occupy the largest acreage, followed by corn, market-garden crops, and potatoes. Hay and forage crops are produced mainly in connection with dairying; whereas, other crops are produced for subsistence and cash.

Transportation facilities are good in both counties, and Providence, Fall River, and Boston are good markets for those agricultural products not consumed locally.

Newport and Bristol Counties lie within the glaciated region of North America, and the materials from which the soils have developed have accumulated largely through glacial action and deposited as till by the receding glacier or as outwash material from the melting glacier. The soils are grouped in six broad groups based on such factors as stoniness, relief, physiography, drainage, agricultural use, and adaptations, as follows: (1) Nonstony well-drained till soils, (2) stony well-drained till soils, (3) soils of the outwash plains, (4) soils of the kames, (5) imperfectly drained and poorly drained soils, and (6) miscellaneous land types.

The nonstony well-drained till soils include the members of the Newport, Bernardston, Compton, Tiverton, Narragansett, and Gloucester series that are free or practically free of surface stone. The soils of this group are by far the most important in the area from an agricultural point of view, and a large proportion of them is under cultivation. In general the relief ranges from nearly level to sloping.

Drainage is good but not excessive, and these soils are capable of being built up to and maintained in a fair to good state of productivity.

The Newport and Bernardston soils are the most extensive of the group and the most productive for the general crops of the area. The Gloucester, Narragansett, and Tiverton soils occupy comparatively small acreages.

The stony well-drained till soils include the stony members of the different soils in the first group. Of these, the stony Gloucester soils are the most extensive and the Bernardston soils the least extensive. Most of this land is in forests, and a small proportion is cleared of trees and is used for pasture or is lying idle. The cost of clearing this land of stones and trees largely prohibits its present use for agriculture other than forestry or grazing.

Soils developed on the outwash plains are represented by the Merrimac and Warwick series. The land is level to gently undulating, and drainage is good to excessive, depending on the texture and structure of the soils. These soils are stone free, easily tilled, and responsive to fertilization. The heavier textured members are productive for general crops, especially vegetables; whereas the lighter textured members are productive for certain crops, if heavily fertilized and if the moisture supply is sufficient.

The soils of the kames have developed on hummocky and uneven relief, and they are shallow and droughty. These soils are represented by the Quonset series and their best use is for grazing and forestry.

The imperfectly drained soils are limited largely to the production of hay and for use as pasture unless artificially drained; whereas the best use for the poorly drained soils unless drained is for forests or for pasture.

Miscellaneous land types include scattered areas of muck and peat; muck and peat, shallow phase; peat, salt-marsh phase; tidal marsh; alluvial soils, undifferentiated; dune sand; coastal beach; rough stony land; made land; and unclassified city land. None of these land types is of any agricultural importance for cultivated crops, and the best use is for forestry, grazing, building sites, and recreational purposes.

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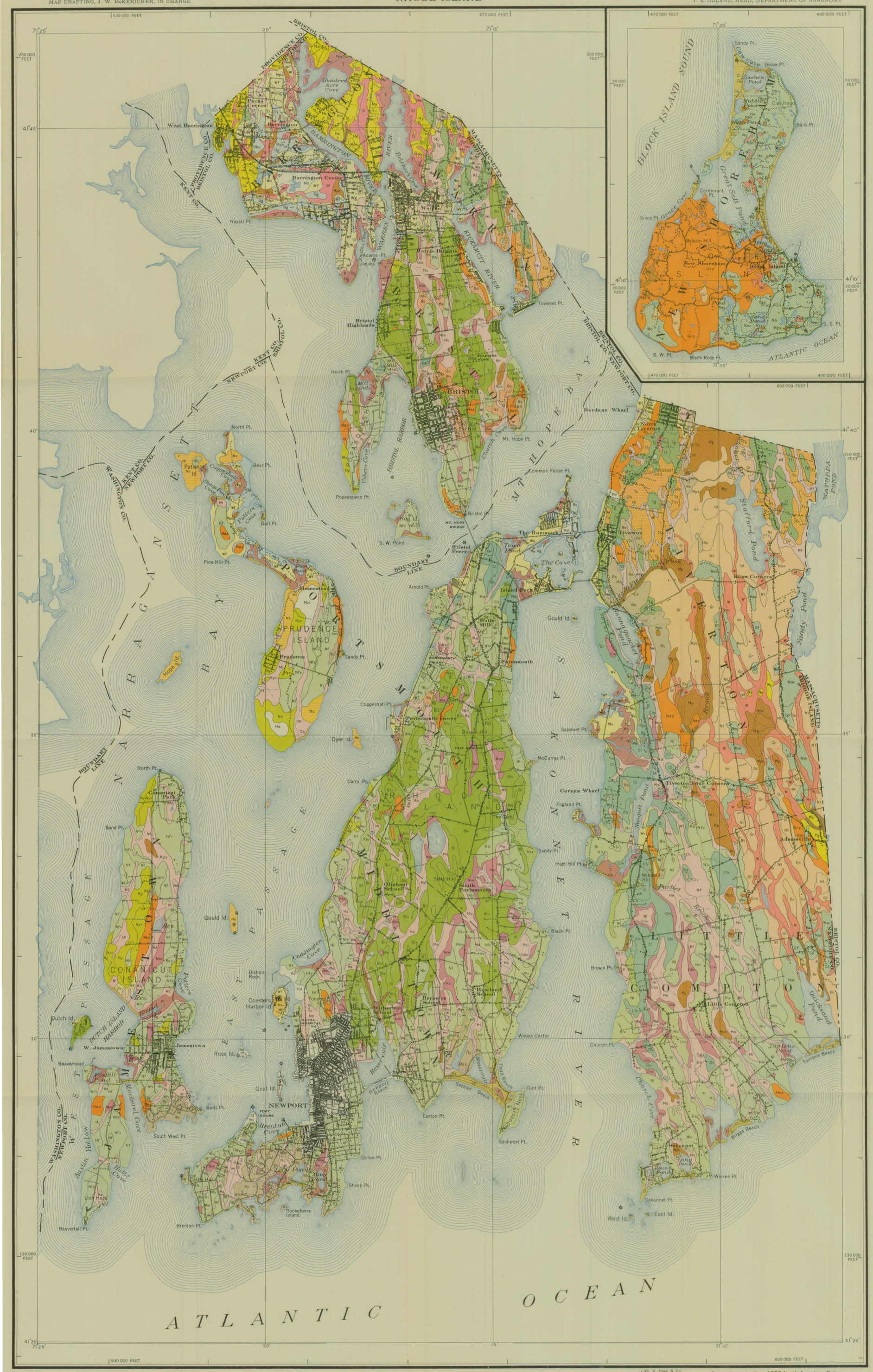
DIVISION OF SOIL SURVEY, CHARLES E. KELLOGG, CHIEF
MAP DRAFTING, J. W. McKERICHER, IN CHARGE

SOIL MAP

NEWPORT AND BRISTOL COUNTIES
RHODE ISLAND

RHODE ISLAND STATE COLLEGE
AGRICULTURAL EXPERIMENT STATION
B. E. GILBERT, DIRECTOR OF RESEARCH
T. E. ODLAND, HEAD, DEPARTMENT OF AGRONOMY



LEGEND

NONSTONY WELL-DRAINED TILL SOILS

SLATY TILL-UNDULATING TO GENTLY ROLLING

- Newport fine sandy loam — Nf
- Newport fine sandy loam, Level phase — Nfv
- Newport loam — Nl
- Newport loam, Level phase — Nlv

SLATY TILL-SLOPING TO STEEP

- Newport loam, Slope phase — Nlx
- Newport loam, Steep phase — Nlz

SLATY TILL-LOAMY SANDS

- Newport loamy sand — Nd
- Newport loamy fine sand — Ny
- Newport loamy fine sand, Level phase — Nyv

SLATY TILL-LESS AMOUNT OF DARK SLATES

- Bernardston loam — Bl
- Bernardston loam, Level phase — Blv

SLATY TILL-GREATER AMOUNT OF DARK SLATES

- Compton loam — Cl
- Compton loam, Level phase — Clv

MIXED TILL-CONGLOMERATES AND SANDSTONES

- Tiverton gravelly fine sandy loam — Tg
- Tiverton gravelly fine sandy loam, Level phase — Tgv
- Tiverton gravelly loam — Tl

GRANITIC TILL

- Gloucester fine sandy loam — Gf
- Narragansett fine sandy loam — Na
- Narragansett fine sandy loam, Level phase — Nav

SLATY OR GRANITIC OUTWASH

- Scarboro fine sandy loam — Sf
- Scarboro loam — Sl

WELL-DRAINED TO DROUGHTY SOILS OF THE OUTWASH PLAINS

SLATY OUTWASH

- Warwick sandy loam — Wa
- Merrimac loamy sand — Me
- Warwick gravelly fine sandy loam — Wg
- Merrimac sandy loam — Mm
- Warwick fine sandy loam — Wf
- Merrimac fine sandy loam — My
- Warwick very fine sandy loam — Wv

DROUGHTY SOILS OF THE KAMES

MIXED MATERIALS

- Quonset gravelly fine sandy loam — Qg

IMPERFECTLY DRAINED AND POORLY DRAINED SOILS

SLATY TILL

- Compton loam, Imperfectly drained phase — Clm
- Mansfield stony loam — Mt
- Newport loam, Imperfectly drained phase — Nlm
- Mansfield loam — Ml
- Mansfield silt loam — Ms

GRANITIC TILL

- Whitman stony loam — W
- Mansfield stony silty clay loam — Mc
- Whitman silty clay loam — Wc
- Mansfield silty clay loam — Ma

STONY WELL-DRAINED TILL SOILS

SLATY TILL

- Newport stony fine sandy loam — Ns

GRANITIC TILL

- Gloucester stony fine sandy loam — Gr
- Narragansett stony fine sandy loam — Nt

SLATY TILL-LESS AMOUNT OF DARK SLATES

- Bernardston stony loam — Bs

SLATY OR GRANITIC TILL-STEEP

- Gloucester stony fine sandy loam, Steep phase — Grz
- Newport stony loam, Steep phase — Nez
- Tiverton stony fine sandy loam, Steep phase — Tfz

MIXED TILL-CONGLOMERATES AND SANDSTONES

- Tiverton stony gravelly fine sandy loam — Ts
- Tiverton stony gravelly fine sandy loam, Level phase — Tsv

MISCELLANEOUS LAND TYPES

SWAMPS

- Muck and Peat — Mp
- Muck and Peat, Shallow phase — Mps
- Rough stony land — Rs
- Coastal beach — Cb
- Dune sand — D

SALT WATER MARSHES

- Peat, Salt-marsh phase — P
- Tidal marsh — T

FIRST BOTTOMS

- Alluvial soils (Undifferentiated) — A
- Made land — Md
- Unclassified city land — Uc

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam, Sawmill, Windmill
- Boundary lines
- School, Church, Creamery, Cemeteries
- Boundary lines
- Triangulation station, Boundary monument, Oil or Gas wells
- U.S. Township and Section lines, Recovered corners
- Forest fire station, Airway beacon, Oil or Gas tanks
- Transmission line, Oil or Gas pipe line
- Mine or Quarry, Rock outcrop, Made land
- Soil boundaries, Stony, Gravelly and Cherty areas

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Prominent hills, Mountain peaks
- Sand, Wash, and Sand dunes
- Bluff, Escarpment, Mine dumps

DRAINAGE
(Printed in blue)

- Streams, Springs, Wells, Flowing wells
- Lakes, Ponds, Intermittent lakes
- Unsurveyed and Intermittent streams
- Water pipe lines, Canals, Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

W. J. Latimer, Inspector, District 1.
Soils surveyed by A. E. Shearin, U. S. Department of Agriculture, in charge, and S. V. Madison and W. S. Colvin, Rhode Island Agricultural Experiment Station.

Scale 1/62500
1 0 1 2 3 4 Miles
1 0 1 2 3 4 5 Kilometers

Lith. A. Hoen & Co.

Polyconic projection, 1927 North American Datum.
Base map in part from U. S. Geological Survey sheets and U. S. Coast Survey charts.
10000 foot grid based upon Rhode Island system of plane coordinates.
Surveyed in 1935-36. Series 1936.